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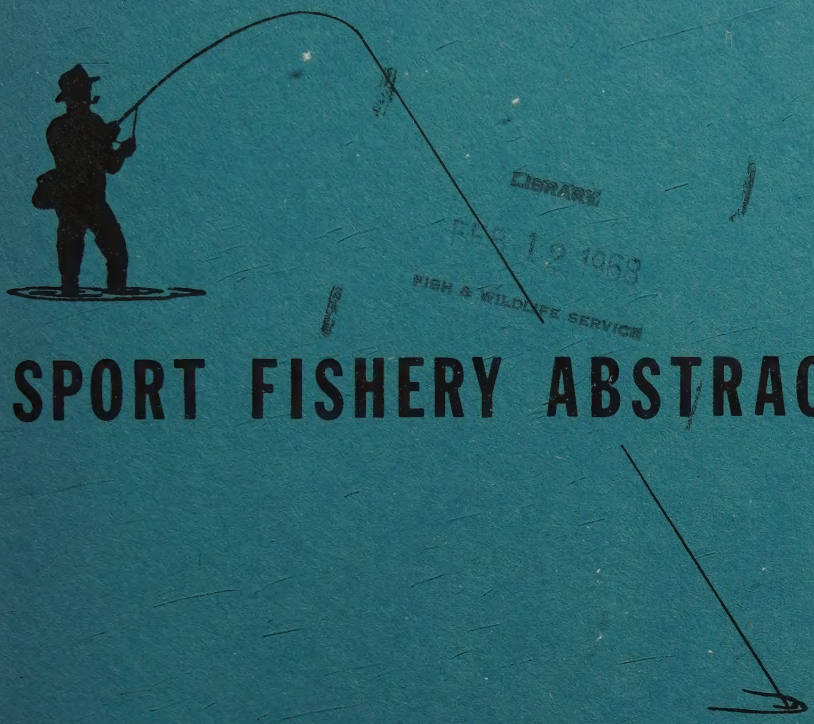

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SPORT FISHERY ABSTRACTS

Vol. 12, No. 4, 1967

Abstracts 9419 - 9550

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BUREAU OF SPORT FISHERIES AND WILDLIFE

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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Washington, D. C. 20240

9419. Premvati, G. (Dept. of Biological Science, Florida State Univ., Tallahassee, Fla.). 1967. Multigonotylus micropteri GEN. ET SP. N. AND Caecincola wakullata SP. N. (DIGENEA: CRYPTOGONIMIDAE) FROM FRESHWATER BASS, Micropterus salmoides. Jour. of Parasitology, 53(4): 743-746.

Two new trematodes of the family Cryptogonimidae are described from the freshwater bass, Micropterus salmoides. Multigonotylus micropteri gen. et sp. n. is characterized by having 7 to 11 gonotyls in the preacetabular region, vitellaria extending from the intestinal bifurcation to the level of the ventrogenital sac, and long ceca reaching to the posterior end of the body. For the reception of this genus, a new subfamily Multigonotylinae has been erected. A new species Caecincola wakullata of the genus Caecincola Marshall and Gilbert, 1905 is described, and compared with the only other species, C. parvulus Marshall and Gilbert, 1905.

9420. Elliott, J. M. (Dept. of Zoology, Univ. of Exeter, and Freshwater Biol. Assoc., Ambleside). 1967. INVERTEBRATE DRIFT IN A DARTMOOR STREAM. Arch. Hydrobiol., 63(2): 202-237.

Monthly samples of invertebrate drift and benthos were taken at different sites in the Walla Brook over a period of 17 months. A shovel sampler was used for the bottom samples and both surface nets and modified plankton samplers for the drift samples. The drift samplers are described. Aquatic, emerging, and terrestrial invertebrates were present in the drift during all seasons of the year. Aquatic invertebrates were the most important component of the drift and nearly all species taken in the bottom samples were also taken in the drift, the exceptions being Tricladida and Trichoptera larvae with stony cases. The density of aquatic invertebrates in the drift appears to be fairly constant for the same months, and at both single and different sites for a short period of time. Under these conditions the numbers of animals in 24-hour drift samples are a reflection of the different amounts of water passing the sampling points. The density of aquatic invertebrates in the drift varies in different months and at different times of the day. In all months, more aquatic invertebrates were taken in the drift at night than in the day, the greatest numbers being in the three hour sample after sunset. The daily fluctuations were related to fluctuations in light intensity. The Hydrachnellae were the only exceptions to the general pattern and were taken in greater numbers in the day samples. Only a small proportion of the benthos (under 0.01%) was in the drift at any instant in time. The detached animals were in the drift for a short period of time and travelled only a short distance if conditions allowed a quick return to the benthos. Aquatic plants in the runs provided a natural sieve for the detached animals and the runs served as a check to drift washed down from the riffles. The detached animals settling in the deep pools soon left, and large numbers of invertebrates drifted out of a deep pool in 24 hours. There was no definite upstream flight of the female imagines and it was concluded that there was no extensive depopulation of the upper reaches of the Walla Brook. Daily fluctuations in drift were also obtained in laboratory experiments. Artificial light suppressed the normal increase in numbers at night. Covering the tank seemed to have no effect, the pattern being identical to that of a normal run. From the work on the Walla Brook and the observations of other workers, it is concluded that most aquatic invertebrates are negatively phototactic, positively thigmotactic, and more active at night. The nocturnal movements are probably associated with foraging and occur on both the upper and lower surfaces of stones. It is suggested that the density of detached animals in the drift reflects both the number of animals moving over the exposed parts of stones and aquatic plants, and the extent of the competition between these animals for food and space. (Auth. summ.)

9421. Wicklund, Robert (Sandy Hook Marine Lab., Highlands, N. J.). 1964. UNDERWATER NIGHT OBSERVATIONS OF MARINE ANIMALS. Underwater Naturalist, 2(3): 19-21.

Observations were made from the R/V Challenger using standard SCUBA and hookah gear, and a cage with four 110V, 375W photo floodlights mounted on top. Pelagic fish were observed by suspending the cage in mid-water from a floating barrel. Among the animals attracted to the light were Atlantic round herring,

anchovies, bluefish, hake, rockling, butterfish, bonito, squid and lobsters. The observations suggest that round herring, Etrumeus sadina, are able to school and orient themselves in the dark. --R. W. Topp.

9422. Bakshtansky, E. L. (Polar Res. Inst. Mar. Fish. and Oceanogr., Murmansk, USSR). 1965. THE IMPACT OF THE ENVIRONMENTAL FACTORS ON SURVIVAL OF THE FAR EASTERN YOUNG SALMON DURING THE ACCLIMATIZATION OF THE LATTER IN THE NORTHWEST PART OF THE USSR. In: International Commission for the Northwest Atlantic Fisheries Environmental Symposium, Rome, January 1964. Int. Comm. Northwest Atlantic Fish Spec. Publ. 6. 477-480; Biological Abstracts, 48(5): Abst. No. 21499. 1967.

The paper deals with some environmental factors that influence the survival of young pink salmon (Oncorhynchus gorbuscha) and chum salmon (O. keta) after their release from the hatcheries. The material is based on the observations carried out on the Kola peninsula during 1959-63. The main factor responsible for the drastic reduction in the number of the released young salmon was predation which was especially great at the time the young entered the sea. (Auth.)

9423. Nikiforov, N. D. 1959. DEVELOPMENT, GROWTH AND SURVIVAL OF THE EMBRYOS AND FRY OF Salmo salar IN NATURAL CONDITIONS. Izvest. Vses. Nauchn.-Issled. Inst. Ozernogi i Rechnogo Rybn. Khoz. 48. 65-79; Ref. Zh., Biol., 1960, No. 66276. (Translation); Biological Abstracts, 48(5): Abst. No. 21579. 1967.

Observations carried out in the Tuloma River in 1957 showed that the number and form of spawning redds depend on the properties of the bottom. An average of 8.1% of eggs spawned by one female remain in the spawning redd. The transition from larva into fry is the critical moment. Twenty individuals per spawning female which makes up 0.17% of the number of eggs spawned, survive to the smolt stage. --Courtesy NSF (PL 83-480) 1963.

9424. Topp, Robert W. (Coop. Fish. Unit, Univ. Mass., Amherst, Mass.). 1964. RESIDENCE HABITS OF THE RED SNAPPER. Underwater Naturalist, 2(3): 15-17.

Recaptures of tagged red snapper and observations of commercial fishermen have allowed speculations on the residence habits of the species: In the spring small fish move shoreward, where they congregate around bottom obstructions and tenaciously remain for the summer. As cooler weather approaches they move into depths of 15 fathoms or more to be recruited into the commercial fishery. Deeper water stocks make feeding excursions from their home grounds; during adverse conditions they become torpid. (Auth.)

9425. Ostroumova, I. N., and S. V. Strel'tsova. 1964. PHYSIOLOGICAL PECULIARITIES OF RAINBOW TROUT WITH UNDERDEVELOPED GILL COVERS. Izv. Gos. Nauch-Issled Inst. Ozern. Rechn. Rybn. Khoz. 58. 135-138. (Engl. summ.). From: Ref. Zh. Biol., 1965, No. 23I47. (Translation); Biological Abstracts, 48(5): Abst. No. 21844. 1967.

Trout with underdeveloped gill covers are characterized by a lower respiration rate, higher O_2 threshold, and a greater number of gill movements per unit time. Hemoglobin and erythrocyte counts of these fishes are above normal; blood formation rate is elevated, and the spleen weighs less than that of healthy fish. In oxygen-deficient water they die more rapidly than healthy fish. (Authors)

9426. Ashby, Kenneth Roy (Dept. Zool., Univ. Durham, Durham, England). 1965. THE EFFECT OF STEROID HORMONES ON THE DEVELOPMENT OF THE REPRODUCTIVE SYSTEM OF Salmo trutta L. WHEN ADMINISTERED AT THE COMMENCEMENT OF SPERMATOGENETIC ACTIVITY IN THE TESTES. Riv. Biol (Perugia) 58(2/3): 139-169. Illus. (Ital. summ.); Biological Abstracts. 48(5): Abst. No. 22472. 1967.

Studies on the development of the reproductive system of the brown trout (Salmo trutta L.) indicate that the period of stasis of the germinal cells in the testis does not end until the lenght of individuals is approaching 6 cm, which is

much later than in the case of the ovary. Spermatogenesis had not proceeded beyond the formation of solid cordons of spermatogonia in the most advanced stage studied when the average length of individuals was 8.4 cm, the culture having been kept at normal outdoor temperatures and the final sample taken at the end of October towards the end of the year 0. The ovaries of a proportion of the females reared under these conditions of temperature contained occasional nests of spermatogonia and spermatocytes. In the females of the final sample the mean diameter of the largest oocytes ranged between 120 and 180 μ in the various individuals sectioned. Steroid hormones were added as alcoholic solutions to the culture medium, from the time when activity of the germinal tissue in the testes was just beginning. Forty μg of estradiol and of testosterone, respectively, 67 μg of progesterone and 80 μg of DOCA were administered 8 hours a day for 2 months and the concentrations doubled for a third month. The estradiol had no effect on the ovaries but increased the extent and intensity of hypertrophy of the somatopleure, speeded the development of the terminal median oviduct and caused enlargement of the urogenital papilla. In the males it caused the elimination of germinal tissue in the testes and a slighter degree of hypertrophy of the somatopleure. Outside the reproductive system, estradiol was apparently responsible for the atrophy of a proportion of muscle fibers in the somites and an increase in basophilia of precipitates from the body fluids. The effects of testosterone were similar to those of estradiol in previous experiments. There was some inhibition of activity of the germinal epithelium in females and the degree of stimulation of development of the terminal median oviduct and of the urogenital papilla was usually less; in males the inhibition of development of the testes was greater, the somatic as well as the germinal tissue being almost completely or completely eliminated. In addition, in both sexes testosterone produced only slightly the changes induced by estradiol outside the reproductive system. Progesterone and DOCA inhibited the activity of the germinal epithelium and the formation of oocytes, but had no further effects on the females. DOCA had no effect on the males; but progesterone induced virtual completion of spermatogenesis. In one individual spermatids maturing into spermatozoa were present. It is concluded that steroid hormones can have truly stimulating, inductive effect on the juvenile gonads. As teleosts are concerned, the evidence supports Ancel's thesis that sexual differentiation is primarily a function of the differing reactivity of the blastemata in the 2 sexes, rather than one of different identity and effect of inductors. Individuals of a culture treated with a higher concentration of alcohol than those used in the various experimental cultures, were indistinguishable from those of the untreated cultures. (Auth.)

9427. Jacoby, Gertrude H., and Cleveland P. Hickman, Jr. (Dept. Zool., Univ. Alberta, Edmonton, Alberta, Canada). 1966. A STUDY OF THE CIRCULATING IODOCOMPOUNDS OF RAINBOW TROUT, Salmo gairdneri, BY THE METHOD OF ISOTOPIC EQUILIBRIUM. Gen. Comp. Endocrinol., 7(2): 245-254. Illus.; Biological Abstracts, 48(5): Abst. No. 22628. 1967.

Repeated injections of $Na^{125}I$, carrier-free and with added ^{127}I, were used to bring Salmo gairdneri into iodine isotopic equilibrium. Thin-layer chromatography revealed increasing quantities of iodotyrosines, thyroxine (T4) and triiodothyronine (T3) in the plasma. At equilibrium T4 and T3 each accounted for a mean 1.2% of the activity while the iodotyrosines shared a maximum 1-1.5% of the activity. It is estimated that 100 gm of S. gairdneri plasma contain 1.1 μg of T4, 1.3 μg of T3 and 1.1 μg of MIT (Monoiodotyrosine) and/or DIT (diiodotyrosine). (Authors)

9428. Hobson, Edmund S. 1964. SHARKS INCREASING VISUAL FIELD. Underwater Naturalist, 2(3): 29.

At least 2 species of sharks can maintain visual contact on an object directly behind them by exaggerating the normal side-to-side motion of the head in swimming. This was noted in Galapagos sharks, Carcharhinus galapagensis and in grey sharks, Carcharhinus sp. --R. W. Topp.

9429. Lebedev, N. V., B. M. Logvinenko, E. V. Fadeev, G. N. Nefedov, L. A. Zil'bermints, and V. A. Dedukhova. 1965. ON THE MOTOR RESPONSES OF ANCHOVY TO ACOUSTIC STIMULI. Nauch Dokl Vyssh Shkoly Biol Nauk 2. 91-94. From: Ref. Zh., Biol., 1966, No. 6I133. (Translation); Biological Abstracts, 48(5): Abst. No. 22782. 1967.

The anchovy reacts not only to sound vibrations, but also to frequencies in the ultrasonic range. Acceleration of motion depends upon sound pressure and frequency. The threshold of sensitivity to sound pressure increases with increasing frequency. A reduction in the reaction of a fish to acoustic signals is determined not by the number of signals, but by the length of time the signals act and, apparently is connected with the tiring of the fish. A shoal of anchovies in a tank, on coming into contact with an acoustic field zone, either moves away or travels along the acoustic beam. A directed acoustic field with a vibration frequency of not less than 10-15 kilocycles/sec., and a sound pressure of not less than 20,000 bars, may be used for controlling the movements of anchovy shoals during fishing. (Authors)

9430. Nakatsukasa, Yasuo. 1965. AN EXAMPLE OF THE HERMAPHRODITIC GONAD FOUND IN Oncorhynchus keta (Walbaum). Jap. J. Ichthyol., 13(1/3): 59-63. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 48(5): Abst. No. 23727. 1967.

A hermaphroditic gonad found in chum salmon, Oncorhynchus keta (Walbaum), was investigated on the external and histological features, and the process of development of the gonad was considered. The histological observation of the gonad shows the following results; there is a septum in common between the testis and the ovary, and there are found absorption and collapse of ovary cells as well as formation of spermatozoa. The facts mentioned above suggest that the gonad developed first as a female type and then converted into a male type. (Auth.)

9431. Paulini, E., and T. Camey (Centro. Pesquisas, Belo Horizonte, Brazil). 1965. FIELD AND LABORATORY TESTS WITH CUPROBAM AS A MOLLUSCICIDE. Rev. Brasil Malariol. Doencas Trop., 17(1): 49-53. (Engl. summ.); Biological Abstracts, 48(5): Abst. No. 25313. 1967.

Cuprobam (copper dimethyl-dithiocarbamate) was tested as a molluscicide both in the laboratory and in the field. The LC_{50} of 24 hours exposure was 3 and 4 ppm for the mature snails and eggs, respectively. The LC_{90} was 7 ppm for both forms. The product was applied in the field at the rate of 0.5 and 1.0 g/m^2. The lower dosage gave only partial reduction but the higher one resulted in better than 95% kill of both mature snails and eggs. In irrigation ditches with flowing water 2 applications within 15 days virtually eliminated all mature snails. The product showed relatively slow action on the snails; it also killed fish and frogs but had no visible effect upon the aquatic vegetation. (Authors)

9432. Schluter, Marlis (Humboldt Univ., Berlin, East Germany). 1966. INVESTIGATIONS OF THE ALGICIDAL CHARACTERISTICS OF FUNGICIDES AND HERBICIDES. Int. Rev. Gesamten. Hydrobiol., 51(3): 521-541; Biological Abstracts, 48(5): Abst. No. 25316. 1967.

Algae were cultured and tested with the commercial fungicides $CuSO_4$, $CuCl_2 \cdot 3CuO \cdot H_2O$, Zn-dimethyl-dithiocarbamate, and the herbicides 6-chlor-2,4-bis-ethylamino-1,3,5-triazin, 3-amino-1,2,4-triazol, and N.N-dimethyl-(4-chlor-phenyl)-urea. The tests were made on the following algae: Anabaena flos-aquae, Oscillatoria agardhii, Nitzschia palea, Ankistrodesmus falcatus, Scenedesmus quadricauda and Hormidium nitens. Results are presented in tabular form, and comparisons are given to the toxicity of the chemicals to fish. --C. C. Davis.

9433. Tzimoulis, Paul. 1964. FIVE TECHNIQUES FOR UNDERWATER FISH PHOTOGRAPHY. Underwater Naturalist, 2(3): 21, 33-35.

Five methods basic to nature photography and accomplished with standard underwater camera equipment are explained: passive waiting against obstructions, baiting, maneuvering a subject from one color background to another, underwater flash, and "fast-pan" techniques. --R. W. Topp.

9434. Krishnamoorthi, K. P., and G. Visvesvara (Cent. Public Health Eng. Res. Inst., Nagpur, India). 1966. HYDROBIOLOGICAL STUDIES IN GANDHISAGAR (JUMMA TANK). SEASONAL VARIATIONS IN PLANKTON (1961-62). Hydrobiologia, 6(3/4): 501-514; Biological Abstracts, 48(6): Abst. No. 26760. 1967.

A qualitative and quantitative study was made of the variations of phytoplankton and zooplankton collected over a period of a year from 3 sampling stations; collections were made from time to time during the day and night. A discussion of the grazing effect of Moina on the phytoplankton is included. The study arose out of a study of a large scale fish mortality. It is noted that the fish mortality occurred at a time when phytoplankton was low and zooplankton high, resulting in low concentrations of oxygen in the water. --K. E. Marshall.

9435. Kwiatkowska-Grabacka, Elzbieta (Res. Center Hydrobiol., Pol. Acad. Sci., Cracow, Poland). 1965. MICROFAUNA OF THE BOTTOM OF FISH PONDS IN GOŁYSZ. Acta Hydrobiol., 7(4): 317-328. Illus. (Pol. summ.); Biological Abstracts, 48(6): Abst. No. 26762. 1967.

The paper deals with results of investigations of Ciliata living on the bottom of fertilized ponds. These species were found feeding on bacteria. Fertilization of fish ponds has a favorable influence on the quantity of microorganisms and on increasing their activity. Probably fertilization has an indirect effect on the protozoan fauna through the intensification of the rate of bacterial processes in the slime of the bottom. --Courtesy NSF (PL 83-480) 1966.

9436. Grimas, Ulf, and Nils-Arvid Nilsson (Inst. Zool., Uppsala, Sweden). 1965. ON THE FOOD CHAIN IN SOME NORTH SWEDISH RIVER RESERVOIRS. Rep Inst Freshwater Res Drottningholm 46. 31-48. Illus. Map; Biological Abstracts, 48(6): Abst. No. 26750. 1967.

Six reservoirs, 2 to 36 years old, differed from natural lakes in greater change of water and from impounded lakes in less annual fluctuation in water level but in more rapid short-term fluctuations of limited amplitude (0.5-1 m). Aquatic vegetation was abundant, particularly in the older reservoirs. Because of turbulence and water change there was no thermal or chemical stratification and littoral benthic organisms were abundant at greater depths (7-23 m) than in lakes. Roach (Leuciscus rutilus), perch (Perca fluviatilis) and pike (Esox lucius) became abundant, with declines in brown trout (Salmo trutta), salmon (Salmo salar) and grayling (Thymallus thymallus). Stomach contents of whitefish (Coregonus spp.) roach, pike, and grayling in the reservoirs are tabulated. Nutritive conditions were not responsible for decline of the salmonid species. --K. D. Carlander.

9437. Alabaster, J. S., and A. L. Downing (Min. Agr., Fish. and Food, London, England). 1966. A FIELD AND LABORATORY INVESTIGATION OF THE EFFECT OF HEATED EFFLUENTS ON FISH. Fish Min Agr Fish Food (Great Brit) Ser I Sea Fish 6(4): 1-42. Illus.; Biological Abstracts, 48(6): Abst. No. 26790. 1967.

The temperature of British rivers, not artificially heated, normally reaches its maximum in July when mean monthly values of 16 to 20°C are usually recorded, though mean values as high as 21°C have sometimes occurred. The highest temperature recorded between 1953 and 1962 was 24.4°C in the River Medway, and between 1908 and 1922 it was 23.5°C in the River Wye. Cooling-water may be warmed by 6 to 9°C in passing through condensers in power stations, but effluent temperatures may exceed the undisturbed river temperature by more than 9°C when there is recirculation of the cooling-water in the river or, with a mixed cooling system, in towers. Heated effluents, by virtue of their high temperature only, may be lethal to caged trout and coarse fish acclimatized to normal river temperatures during the summer and may also occasionally kill free-living fish which are near effluent outfalls when temperatures increase rapidly. The smaller free-living fish are mainly affected, larger fish apparently being able to swim away to safety. Usually there is a layer of warm water at the surface of rivers receiving heated effluent, leaving beneath it water of almost normal temperature in which coarse fish can and do live in as great an abundance and variety as elsewhere in the river. Where the temperature of the whole river is above normal because of

mixing with a continuous discharge of heated effluent, populations of coarse fish may be locally reduced when mean daily temperatures reach 30°C, and increased when the water is warmed to not more than 26°C. (Authors)

9438. Demel, K., and J. Kulikowski. 1965. FISHING OCEANOGRAPHY: NATURAL GROUNDS OF MARINE FISHERY. 223 p. Illus. PWN-Polish Scientific Publishers: Warsaw, Poland. Pr. $6.00; Biological Abstracts, 48(6): Abst. No. 26808. 1967.

This volume is a translation of the Polish work "Oceanografia rybacka", and is available from the Office of Technical Services, U.S. Department of Commerce, Washington, D.C. As the original work was published in 1955, the book has been brought up to date to include recent results in world catches according to the Yearbook of Fishery Statistic-F.A.O.-1960. The present monograph is intended to provide a comprehensive outlook on phenomena occurring in marine surroundings, with particular emphasis given to agents affecting fish life, and to offer some practical hints on its exploitation. In its original edition, it was in fact an unprecedented work in Polish reference literature. There is a bibliography.

9439. Evropeitseva, N.V. 1959. CULTIVATION OF Salmo salar L. TO THE SMOLT STAGE IN PONDS, WITH FOOD PRODUCED BY ZONAL FERTILIZATION. In: Proceedings of the Sixth Conference on the Biological Problems of Inland Waters, 1957. Akad. Nauk SSSR: Moscow-Leningrad. 86-93.; Referat Zhur., Biol., 1960, No. 61115; Biological Abstracts, 48(6): Abst. No. 26814. 1967. --Courtesy NSF (PL 83-480) 1963.

9440. Frank, Stanislav (Dept. Zool., Charles Univ., Prague, Czechoslovakia). 1966. A CONTRIBUTION TO THE GROWTH OF SEA-TROUT (Salmo trutta trutta Linnaeus 1758) IN POLAND. Vestnik Cesk Spolecnosti Zool., 30(1): 14-21. Illus.; Biological Abstracts, 48(6): Abst. No. 26816. 1967.

The age and rate of growth was examined in 399 sea-trout from the Vistula mouth (Swibno), Raba (Gdów) and Dunajec (Roznów) according to the year increments of scales. Most fish spend 2 years of their life in the river on their way to the sea. Half of the fish with spawning marks on their scales came back to the rivers for spawning at age 4+ and the majority of sea-trout spawned only once in their life. (Auth.)

9441. Galkina, L.A. 1965. SOME PROBLEMS IN EGG INCUBATION AND REARING OF JUVENILE PACIFIC SALMON IN HATCHERIES OF THE MURMAN REGION. In: Theoretical bases of fish culture. Nauka: Moscow. 177-182. From: Ref. Zh., Biol., 1965, No. 23I103 (Translation); Biological Abstracts, 48(6): Abst. No. 26820. 1967.

Chum and pink salmon eggs, which were transported from Sakhalin to Murman fish hatcheries for the purpose of acclimatizing these fishes in the Barents and White Seas, were found to have different qualities. The differences between the eggs are responsible for the embryos reacting differently to the environmental factors during subsequent periods of egg incubation and the rearing of young in the habitats of the introduced species. In acclimatizing these fishes it is essential to recognize that the eggs of pink salmon are capable of developing at lower temperatures than are chum eggs.

9442. Galkina, Z.I. 1964. THE TOLERANCE OF RIVER LAMPREY (Lampetra fluviatilis L.) TO MECHANICAL INFLUENCES AND TO OXYGEN DEFICIENCY IN EARLY STAGES OF ONTOGENY. Izv Gos Nauch-Issled Inst Ozern Rechnogo Rybn Khoz 58: 191-195. (Engl. summ.). From: Ref. Zh., Biol., 1966, No. 1I141. (Translation); Biological Abstracts, 48(6): Abst. No. 26821. 1967.

The effect of mechanical action on developing eggs and larvae of lamprey (up to 20 days of age) was investigated. In addition, observations were carried out on the effect of an O_2 deficit on larvae. The highest sensitivity to mechanical influences was observed at the start of larval development, from gastrulation to formation of embryonal axial organs. Subsequent to this period the tolerance of eggs to mechanical

influences increased and remained high up to the time of hatching and during the period of larval development. Highest mortality (10%) was observed on the 4th day after hatching. The tolerance of larvae to an O_2 deficit was highest on the 8-12th day after hatching. With an initial O_2 concentration of 0.4-0.66 mg/l, the larvae became inactive after 6-8 hours without dying. The tolerance of larvae to an O_2 deficit diminished with age and transition to active feeding: at 24-28 days after hatching, at an initial O_2 concentration of 0.46-0.53 mg/l, the larvae became inactive within 1-2 hours and died in 3 hours.

9443. Gladkova, M. G. 1960. ARTIFICIAL BREEDING OF GRAYLING IN THE IRKUTSK RESERVOIR. Rybn. Khoz. 2. 39-40; Referat. Zhur., Biol., 1960, No. 81603; Biological Abstracts, 48(6): Abst. No. 26824. 1967.

9444. Klontz, George W., William T. Yasutake, and A. John Ross (Western Fish Disease Lab., Seattle, Wash.). 1966. BACTERIAL DISEASES OF THE SALMONIDAE IN THE WESTERN UNITED STATES: PATHOGENESIS OF FURUNCULOSIS IN RAINBOW TROUT. Amer. J. Veterinary Res., 27(210): 1455-1460.

The sequential pathologic changes that occur in rainbow trout following intramuscular inoculation with virulent Aeromonas salmonicida cells, the cause of furunculosis in hatchery-reared salmonids, are described. A definite focus of infection persisted at the injection site during the entire study. During the first 8 hour postinoculation (PI), a transient bacteremia occurred. At the site of the injection there was marked inflammatory response consisting of lymphocytes, neutrophilic granulocytes, macrophages, and fibroblasts. After 40 hours PI, there was a noticeable diminution of these inflammatory elements in the area of the injection. At this time, also, there were degenerative changes occurring in the anterior kidney and spleen. At the 56th hour PI, the bacteremia recurred. By the end of the 3rd day (72 hour PI), the kidney, spleen, and site of injection were devoid of granulocytes and macrophages and were undergoing marked liquefaction necrosis. Some of the fish were dead by the 4th day PI with the death being attributed to the massive bacteremia. (Authors)

9445. Levaditi, J. C., P. Besse, P. de Kinkelin, and J. C. Guillon. 1965. HISTOPATHOLOGIC TESTS IN THE IDENTIFICATION OF DISEASES OF FISH: APPLICATION TO SALMON CULTURE. Acad. Veterinaire France Bull., 38(5): 173-183. Illus.; Biological Abstracts, 48(6): Abst. No. 26849. 1967.

9446. Lindstrom, Thorolf (Inst. Freshwater Res., Drottningholm, Sweden). 1965. CHAR AND WHITEFISH RECRUITMENT IN NORTH SWEDISH LAKE RESERVOIRS. Rept. Inst. Freshwater Res. Drottningholm 46. 124-140. Illus.; Biological Abstracts, 48(6): Abst. No. 26851. 1967.

Failure of year-class abundance to be correlated with amplitude of winter drawndown does not necessarily indicate that recruitment is undamaged. Evaluation is made more difficult by changes in fish distribution and spawning time, difficulty in correctly assigning ages, growth changes which affect catchability, environmental changes, and taxonomic problems. The damming-up phase is usually characterized by good fish growth and some year-classes but predation and food habits are inadequately known. These are also poorly known in the drawdown phase. Young fish abundance can rarely be evaluated in reservoirs. Yearling and other fish below exploitable size can be evaluated more readily but present many problems. Year-class abundance derived from spawning char in Lake Jormsjön show no effect of conversion of lake to reservoir, but the modal age at spawning dropped from 5 to 4 suggesting changes in mortality rates and recruitment. Contradictory data from various sources indicate need for more information on recruitment changes with impoundment. --K. D. Carlander.

9447. Ogawa, Yoshinori, and Yoshio Takemura. 1966. EXPERIMENTS ON THE ATTRACTIVENESS OF ARTIFICIAL REEFS FOR MARINE FISHES: I. PRELIMINARY OBSERVATIONS ON SMALL MODELS IN THE LABORATORY. Bull. Tokai Reg. Fish. Res. Lab., 45. 107-114. Illus. (In Jap. with Engl. summ.); Biological Abstracts, 48(6): Abst. No. 26879. 1967.

Preliminary observations were made on small models (20 x 20 x 15 cm) put in a steelframed glass aquarium (180 x 50 x 45 cm). Three species of fish were selected for observation: Girella punctata (90-120 mm in length), Parapristipoma trilineatum (110-127 mm) and Oplegnathus fasciatus (100-120 mm). Usually 10 or 20 fishes were used at a time. Records of distribution of experimental fishes in the aquarium were taken from the side on the film by means of an automatically controlled camera. The effects of the models on the behavior of experimental fishes were evaluated by the change in distribution of fishes. In so doing, the distribution pattern when there were no models in the aquarium was taken as a standard. When the model reefs were put in the aquarium, considerable changes were nearly always observed to increase the percentage of fishes in the division where the models were put. Effectiveness of model reefs to attract fishes varied depending on the shape and size of the models, but the variation was irregular and conflicting. (From auth.)

9448. Shabalina, A. A. 1964. EFFECT OF COBALT CHLORIDE ON THE DEVELOPMENT AND GROWTH OF RAINBOW TROUT (Salmo irideus). Izv. Gos. Nauch-Issled Inst. Ozern Rechnogo Rybn Khoz., 58. 139-149. (Engl. summ.). From: Ref. Zh., Biol., 1965, No. 23146. (Translation); Biological Abstracts, 48(6): Abst. No. 26907. 1967.

The effect of various concentrations of cobalt on egg development and growth of fingerling, yearling and 2-year-old rainbow trout was investigated. In the blastomere blastula stage, the rate of division was inhibited by Co ($CoCl_2$ concentration 5, 0.5 and 0.005 mg/l). Larvae started hatching most rapidly at a concentration of 5 mg/l; yolk-sac absorption was slower at this than at other concentrations and in controls. Addition twice a week of 0.5 mg of $CoCl_2$ per 10 g of fish caused 43-day fingerlings with an average weight of 337 mg to grow faster than controls (toward the end of the experiment the difference in weight between experimental animals and controls was 2%). In the first half of the growth period, the weight of yearling rainbow trout receiving 3 mg/kg of Co twice a week was similar to that of the controls; by the end of the experiment the weight difference between them amounted to 32%. Apart from this, total fat content, liver fat content and initial melting point of fat were lower, while blood serum protein level was higher, in experimental rainbow trout than in controls. Best hematological indices were observed in yearling rainbow trout exposed to a dietary source containing 5 mg of Co. Addition of Co and Fe at levels of 0.05 mg/kg and 0.1 mg/kg, respectively, to the ration of 2-year-old (2+) rainbow trout has resulted in increased growth, and weight gain was 27% above control weight. In the treated group also, Hb content increased and the thermal shock temperature rose. The fishes' tolerance to an O_2 deficit increased at the beginning of the experiment. At the end of the experiment, treated rainbow trout withstood an O_2 deficit less successfully than did controls.

9449. Shamardina, I. P. 1957. STAGES OF DEVELOPMENT OF THE PIKE. Tr. Inst. Morfol. Zhivotnykh. Akad. Nauk SSSR 16. 237-298; Referat. Zhur., Biol., 1959, No. 37866 (Translation); Biological Abstracts, 48(6): Abst. No. 26908. 1967.

In postembryonic development of the pike 10 stages (S) may be distinguished. Each of these stages is characterized by a specific type of adaptation of the fish to surroundings and by definite features of morphology, ecology, diet, growth rate and respiration level. The ratios between the dimensions of the head, snout, eyes and the various parts of the intestine expressing differences of growth rate of these parts of the body, represent essential characteristics of each stage. The dimensions of specimens of the same stage vary within certain limits, while with carp and perch the dimensions are stable and the passing to the following stage is related to a certain lengthening of the body. The duration of separate stages in the pike is measured in days and weeks; the passing to a subsequent stage occurs in a few hours. In the case of artificial breeding, mobile food is permanently required in all stages; in the first 6, when the respiratory demands are great, sufficient O_2 should be provided and beginning with the 6th stage, when the larvae reach 18 mm, it should be regularly supplied with fish food. During the first stages this may be replaced by larvae of chironomids and mayflies. --Courtesy NSF (PL 83-480) 1963.

9450. Shpet, G. I., and M. B. Fel'dman. 1959. OXYGEN BALANCE IN CARP PONDS AND INTENSIFICATION OF CARP-BREEDING FARMS. In: Proceedings of the Sixth Conference on Biological Problems in Inland Waters 1957. Akad. Nauk SSSR: Moscow-Leningrad. 48-58; Referat. Zhur., Biol., 1960, No. 61082. (Translation); Biological Abstracts, 48(6): Abst. No. 26911. 1967.

Oxygen scarcity limits the density of carp in ponds. Photosynthesis of phytoplankton and submerged macrophytes is the main source of O_2, the role of atmospheric aeration and water exchange being insignificant. Aquatic vegetation in fish ponds should not be destroyed. --Courtesy NSF (PL 83-480) 1963.

9451. Solewski, Wlodzimierz (Res. Center Hydrobiol., Pol. Acad. Sci., Cracow, Poland). 1965. THE ICHTHYOFAUNA OF THE BIAŁKA TATRZAŃSKA STREAM WITH SPECIAL RESPECT TO THE CHARACTERISTICS OF BROWN TROUT (Salmo trutta morpha fario L.). Acta Hydrobiol., 7(2-3): 197-224. Illus. (Polish summ.); Biological Abstracts, 48(6): Abst. No. 26915. 1967.

Brown trout is the most common fish caught in the Białka Tatrzańska stream. On account of the dominating role of the brown trout in the composition of the fish population and because of the appearance of the other fish typically found in trout waters, the Białka stream can be classified as a typical trout water stream. The brown trout lives here and the average density is 2369/ha. --Courtesy NSF (PL 83-480) 1966.

9452. Wade, W. Frank, and Richard E. Craven (Dept. Zool., Okla. State Univ., Stillwater, Okla.). 1966. CHANGES IN FISH FAUNA OF STILLWATER CREEK, PAYNE AND NOBLE COUNTIES, OKLAHOMA, FROM 1938 to 1965. Proc. Okla. Acad. Sci., 46: 60-66; Biological Abstracts, 48(6): Abst. No. 26939. 1967.

The results of 3 surveys of the fish fauna conducted in 1938, 1950 and 1965 are discussed. The species are listed in decreasing order of abundance at various stations. During the 27-year period the fish fauna has been affected by increasing sewage effluent, changes in land use practices, construction of impoundments on the watershed, and introduction of fishes. (Authors)

9453. Wendt, Curt (Inst. Zoophysiol., Univ. Gothenburg, Gothenburg, Sweden). 1965. LIVER AND MUSCLE GLYCOGEN AND BLOOD LACTATE IN HATCHERY-REARED Salmo salar L. FOLLOWING EXERCISE IN WINTER AND SUMMER. Rep. Inst. Freshwater Res. Drottningholm 46. 167-184; Biological Abstracts, 48(6): Abst. No. 26941. 1967.

Trout kept 18-22 hours in dark basins had significantly lower blood lactate values than in usual "unexercised" condition, 3.5 mg% compared to 7.5 at 0.2°C and 14.6 compared to 49.3 mg% at 15°C. Muscle and liver glycogen levels did not change. Inclusion of lateral red muscle with epaxial muscle raised muscle-glycogen levels 0.475± 0.284 compared to 0.300± 0.170 g%. Precocious males had higher liver and muscle glycogen than did immature males in Feb.-March and were excluded. The average unexercised liver and muscle glycogen levels were in winter 1.40± 1.37 g% and -.190± 0.089 g% and in summer 3.85± 1.11 g% and 0.593± 148 g% respectively. Ratio of liver to muscle glycogen was about 7:1 both times. Summer diet included some raw meat but winter diet was entirely pellets. Starvation for 25 days in winter caused no decline in liver or muscle but 21 days starvation in August caused significant decreases. Exercise to exhaustion decreased muscle glycogen 70% in winter and 50% in summer but did not influence liver glycogen. Exercise to exhaustion raised average blood lactate to 38.8± 13.3 mg% in winter and to 76.3± 9.9 in summer. In the following 2 hours mean lactate levels rose to 57.1± 18.3 in winter and 175.4± 35.0 mg% in summer. Fatigue occurred in 32± 8.1 min. in winter and 21± 5.2 min. in summer. After 15 hours of recovery blood lactate level was 5 times as high as unexercised level in winter and 1.5 times in summer. Liver glycogen and coefficient of condition declined when starved fish were acclimated from 0.2°C to 11.5°C but these fish showed longer period of exercise to exhaustion. Coefficient of condition declined from 1.257 to 0.974 with 27 days starvation in August but starvation showed little effect in February. --K. D. Carlander.

9454. Zabolotskii, A.A. 1959. BENTHOS OF THE PODCHEREM RIVER AND ITS ROLE IN THE FEEDING OF YOUNG ATLANTIC SALMON. Izvest. Vses. Inst. Ozernogo i Rechnogo Rybn. Khoz., 48: 44-64; Referat. Zhur., Biol., 1960, No. 95591. (Translation); Biological Abstracts, 48(6): Abst. No. 26947. 1967.

In a clear mountain river the basic biocenosis is that of boulder-pebble ground. The biomass of benthos is 3.5 g/m^2 and is composed mainly of larvae of caddisflies (Trichoptera), mayflies (Ephemeroptera) and chironomids, as well as small mollusks and oligochaetes. Plankton is nearly non-existent. The 2- to 4-year-old salmon feed chiefly on fauna of the rapids: larvae and pupae of Trichoptera, Ephemeroptera, aerial insects, and fish. The latter was practically the only kind of food in a closed, stagnant flood plain lake. In addition to organisms mentioned, mollusks are important in the feeding of grayling; they are also the principal item of diet of whitefish. Larvae of chironomids and of other dipterans predominated in the dissected stomachs of ruff and loach; stone sculpin fed on larvae of Trichoptera, Ephemeroptera and chironomids; perch on fish-minnow (Phoxinus phoxinus) on algae of encrusting organisms. Ruff and grayling are the principal competitors of young salmon. --Courtesy NSF (PL 83-480) 1963.

9455. Chapman, Heather M., and H.B. Naylor ("Shell" Res., Limited, Kent, England). 1966. ISOLATION OF Clostridium botulinum TYPE E FROM CAYUGA LAKE FISH. Appl. Microbiol., 14(2): 301-302; Biological Abstracts, 48(6): Abst. No. 29492. 1967.

9456. Taba, Stanley S., Joseph R. Murphy, and Herbert H. Frost (Brigham Young Univ., Provo, Utah). 1966. NOTES (RECORDS, ECOLOGY) ON THE FISHES OF THE COLORADO RIVER NEAR MOAB, UTAH. Proc. Utah Acad. Sci. Arts and Letters, 42(2): 280-283; Biological Abstracts, 48(6): Abst. No. 31214. 1967.

9457. Kuroki, Toshiro, Ken-Ichiro Kyushin, Rihei Kawashima, and Osamu Sato (Fac. Fish., Hokkaido Univ., Sapporo, Japan). 1965. A TRIAL SETUP OF THE SEMI-AUTOMATIC SCALE READING RECORDER. Bull. Fac. Fish. Hokkaido Univ., 16(2): 83-113. (In Jap. with Engl. summ.); Biological Abstracts, 48(7): Abst. No. 21405. 1967.

A semi-automatic machine for the ridge number and radius of fish scales is described. The scales are made into impressions on a transparent plastic card, set on a microprojector, magnified 50 or 100 times, the ridge number and radius ready by a photoelectric system, and recorded by special pen. The observer must set the focal point and select the axis to read. --S. Springer.

9458. Protasov, V.R. 1965. SOUND SIGNALS OF FISHES. In: Bionika (Bionics). Nauka: Moscow. 251-255. From: Ref. Zh., Biol., 1966, No. 5I123. (Translation); Biological Abstracts, 48(7): Abst. No. 31738. 1967.

Acoustic signalling in fishes arises under conditions characterized by a definite noise level. In connection with this, observations were made on the range of various signals of fish. Three types of most common signals were investigated--those associated with spawning, danger, and the presence of food. Sounds produced during feeding attracted the fish from a distance of 1.0 to 1.5 m. Danger signals were effective at a distance of 1.0 to 1.5 m. Spawning signals had the greatest range of effectiveness (1.0-2.5 m). Feeding and danger signals consisted of a wide band of frequencies and bore the character of noise. Spawning sounds were shown to have a narrow band of fundamental frequencies and to be pulse-like in character. Fish may hear sounds without reacting to them. Based on the hypothesis that fish signals become inaudible when their intensity falls below the noise level, the effective ranges of various sounds were estimated. Sound signals (feeding sounds) that were louder than background noises could be distinguished by both fish and man. Rhythmic signals (spawning sounds) were well perceived by fish and man even when the signals were drowned amid surrounding noises. It is suggested that the rhythmic structure of spawning signals is free from interferences.

9459. Hobson, Edmund S. (Tiburon Marine Lab., Tiburon, Calif.). 1965. A VISIT WITH EL BARBERO. Underwater Naturalist, 3(3): 5-10.

The butterflyfish, Heniochus nigrirostris, locally called "el barbero," has been observed in the Gulf of California in a symbiotic relationship involving removal of ectoparasites and diseased tissue from the bodies of some fishes. Aggregations of these "cleaners" maintain well established stations at various points over the rock bottom where they await fishes requiring their services. Fishes observed visiting these stations include the lookdown, Selene oerstedi, striped grunt, Haemulon sexfasciatum, needlefish, Strongylura fodiator, sierra mackerel, Scoberomorous sierra, and goatfish, Mulloidichthys rathbuni. The latter display a remarkable color change during the process, perhaps as a visual signal between the goatfish and cleaner, or possibly to make the parasites more visible to the cleaner. --R. W. Topp.

9460. Brewer, Jack. 1965. MARINE LIFE ON THE ARTIFICIAL REEF OFF FIRE ISLAND, NEW YORK. Underwater Naturalist, 3(3): 11-14.

Observations were made on July 31, 1965, by an American Littoral Society team of the Fire Island Ocean Reef, often called the "Schaefer Reef", under construction about 2 miles east-southeast of Fire Island Inlet in 70 feet of water. The 3-year-old reef consists of large boulders and all types of building rubble. Numerous sea bass, squirrel hake, flounder, cunner, and ocean pout, a few goosefish, conger eel and tautog, plus several lobsters and other invertebrates were noted. --R. W. Topp.

9461. Meltzoff, Stanley. 1966. EXPLORING A "NEW WORLD" BARRIER REEF. Underwater Naturalist, 3(4): 27-32.

A geographical and biological description and map is provided for the barrier reef extending from the southernmost tip of Yucatan to the Gulf of Honduras. The reef, 150 miles long and running about 15 miles from land along a drowned coastline, has 4 ecological zones associated with it: the coral side, facing the blue and dropping into the deep, housing groups of mixed fish species including grouper, rockfish, snapper, jewfish, and swarms of smaller species; the wide shallow area between the barrier and the sand banks behind it, with extensive coral heads and occasional deep caves, the area between the shore and the sand banks, often turbid but highly productive as a nursery area; and the outlets which cut through the wall of the reef. --R. W. Topp.

9462. Junge, Charles O., and Jiri Libosvarsky (Inst. Math., Czech. Acad. Sci., Prague, Czechoslovakia). 1965. EFFECTS OF SIZE SELECTIVITY ON POPULATION ESTIMATES BASED ON SUCCESSIVE REMOVALS WITH ELECTRICAL FISHING GEAR. Zool. Listy, 14(2): 171-178. Illus. (Czech. summ); Biological Abstracts, 48(7): Abst. No. 31953. 1967.

It is suggested that because of the increased efficiency of electrical gear in small streams, population estimates based on successive removals may be preferable to mark-recapture methods in some cases. Convenient formulae for estimating the total population and the probability of capture on a single trial are given for triplicate fishings. Some indication of the magnitude of the bias due to selectivity by size is given. The probability of capture is computed for different size groups of 3 species of fish common to the small streams in this country, chub (Leuciscus cephalus), gudgeon (Gobio gobio), and brown trout (Salmo trutta). (Authors)

9463. Mironova, N. V. 1965. GROWTH OF TILAPIA (Tilapia mossambica Peters) UNDER AQUARIAL CONDITIONS. Dokl. Akad. Nauk. SSSR, 165(5): 1179-1181. Illus.; Biological Abstracts, 48(7): Abst. No. 31979. 1967.

Two groups of Tilapia were studied: 18 males and 6 females obtained at an age of about 5 months and which reached 17 months at the end of the experiment (the older group) and (2) fry (initially, 255 fish, 33 at the end of the experiment), grown in the laboratory and which reached the age of 12 months (the younger group). The fish of the younger group and some of the fish of the older group were fed exclusively with food of animal origin. The other portion of the Tilapia of the older group were

initially also fed food of animal origin (chiefly bloodworms, in lesser quantity, Tubifex and Daphnia). They then began to receive a green mass of various plants, and finally were shifted to a purely plant food, except in the winter when they again received only bloodworms. The fish which were fed with animal fodder grew more intensively than the fish which received mixed and plant food. T. mossambica grow at a comparatively high rate at an early age. The rate of growth was quite plastic and variable. It is possible to obtain high indexes of linear and weight growth of Tilapia even under aquarial conditions. --D. Franklin.

9464. Penaz, Milan (Ustav Vyzkum Obratlovcu, Czech. Acad. Sci., Brno, Czechoslovakia). 1965. THE INFLUENCE OF AMMONIA ON EGGS AND YOUNG OF Salmo trutta m. fario. Zool. Listy, 14(1): 47-54. (Ger. summ.); Biological Abstracts, 48(7): Abst. No. 31990. 1967.

The tolerance of eggs and young fish of Salmo trutta to ammonia was tested under laboratory conditions. None of the concentrations (up to 50 mg/l) was found to be completely lethal to the eggs, although the receptiveness increased with the higher ammonia concentrations. The long term influence of ammonia on trouts is not known, although the animals from exposed eggs showed an increased tendency to hydrocoele embryonalis. The tolerance of eggs to ammonia or other poisons appears greater in the early developmental stages. None of the young trouts exposed to ammonia died, but even with concentrations of 2.10 mg/l some irreversible damage to heart and muscle control was observed. The older trouts reacted much faster to the poison than the less mature ones. --J. Burnett.

9465. Zaks, M.G., and M.M. Sokolova (Excretory Process Evolut. Lab., Leningrad, USSR). 1965. CHANGES IN TYPE OF OSMOREGULATION OF THE RED SALMON Oncorhynchus nerka Walb. DURING DIFFERENT PERIODS OF ITS MIGRATION CYCLE. Vop. Ikhtiol., 5(2): 331-337. Illus.; Biological Abstracts, 48(7): Abst. No. 32029. 1967.

The study embraced parallel existence of hypotonic and hypertonic osmoregulation in 4 groups of migratory O. nerka (descending smolt, smolt captive in fresh water, returning salmon before it entered a river mouth and during its upriver migration). Results confirm the existence of both regulatory systems in the descending smolt. Hypotonic regulation becomes dominant in fish captive in fresh water. Hypertonic capabilities are lost by salmon returning to spawn. It is concluded that osmoregulation in migrants becomes similar to the systems present in fresh water fish or in marine teleosts at various points of the migrant's life cycle. --B. Le Bental.

9466. Danyulite, G.P., and K.I. Prits (Elec. Fish. Lab., Klaipeda, USSR). 1965. THE REACTION OF FISH TO PULSATORY ELECTRIC CURRENT. Vop. Ikhtiol., 5(2): 338-346. Illus.; Biological Abstracts, 48(7): Abst. No. 32255. 1967.

Individual fish and groups of fish (primarily Baltic herring Clupea harengus membras, also Baltic cod Gadus morhua L., and smelt Osmerus eperlanus L.) were exposed to electrical fields produced in sea water aquaria (148x5845 cm, salinity 6 to 8 ‰) by a thyratron pulser model IG2 (f=1 to 80-100 pulse/sec; τ=0.01 to 10 msec; steep pulse edge) or by an IG7 electronic pulser (f=1-2 cps to 10 Kcps; τ=0.02 to 10-15 msec; square pulse). Differences in potential were measured and bodily reactions of the fish were observed. Results indicate that the onset of individual reaction stages (i.e., excitation, anodic attraction, electronarcosis) depends greatly on frequency, duration and voltage of the current pulses. Optimal parameters for excitation were 1.0 msec and several cps, for anodic attraction much longer pulses (0.2 to 0.4 of total period) and similar frequencies, for electronarcosis f=80 to 150-200 pulse/sec. for the herring and 40-100 pulse/sec. for the cod. --B. Le Bental.

9467. Zueva, K.D. (Cent. Fish Restocking Lab., Leningrad, USSR). 1965. THE SMOLTING PROCESS IN THE HUMPBACK SALMON Oncorhynchus gorbuscha Walb. WHEN THE PARR STAGE DOES NOT OCCUR. Vop. Ikhtiol., 5(2): 324-330. Illus.; Biological Abstracts, 48(7): Abst. No. 33142. 1967.

The development of melarine and guanine pigmentation in O. gorbuscha, O. keta, and Salmo salar L. is traced comparatively from one-day-old larval stages to the smolt stage. The condition of thyroid glands (histological procedure described) at the inception of guanine deposition in the skin is also discussed. Results indicate a congregation of melanine pigment cells along the lateral line in all named species. The pattern develops into "spots" in O. keta and S. salar, but it is halted at that point in O. gorbuscha. This occurs in conjunction with an early change to a silvery color of the body, indicating the smolting process. Smolting is also indicated by a hyperfunctional condition of the thyroid gland which coincides with the inceptive deposition of guanine. This is most clearly pronounced in S. salar, but is adequately evident also in the other 2 species.--B. Le Bental.

9468. Edelhauser, Henry F., J. Russell Hoffert, and Paul O. Fromm (Marquette Univ., Sch. Med., Milwaukee, Wis.). 1966. WATER PERMEABILITY OF NORMAL AND PATHOLOGICAL LAKE TROUT CORNEAS. Proc. Soc. Exp. Biol. Med. 122(4): 963-966; Biological Abstracts, 48(7): Abst. No. 33190. 1967.

Experiments with corneas in vitro have shown that water permeability of lake trout (Salvelinus namaycush) corneas was the same whether the data are based on the transfer of tritiated water from the epithelial to the endothelial bathing media or visa versa. This occurred despite the presence of an osmotic gradient which favored movement of water through the cornea to the solution bathing the endothelium. Permeability constants for normal and denuded corneas indicate that the endothelium offers some resistance to the transfer of water into or across the fish cornea but the major resistance to this movement is provided by the epithelial layer. Correlations between water permeability and histopathological condition of the diseased corneas are noted. (Authors)

9469. Sisk, Morgan E., and Robert R. Stephens (Dept. Zool., Okla. State Univ., Stillwater, Okla.). 1964. Menidia audens (PISCES: ATHERINIDAE) IN BOOMER LAKE, OKLAHOMA AND ITS POSSIBLE SPREAD IN THE ARKANSAS RIVER SYSTEM. Proc. Okla. Acad. Sci., 44: 71-73; Biological Abstracts, 48(7): Abst. No. 36231. 1967.

M. audens Hay has become established in Boomer Lake, Payne County, Oklahoma. The sp. was introduced into the lake in Sept. 1961. Formerly restricted to the Red River system in Oklahoma, its presence in Boomer Lake represents the first record from the Arkansas drainage and extends the northern range of the sp. in Oklahoma approximately 150 air miles. Relations with Labidesthes sicculus (Cope) in Lake Texoma and its future in Keystone Reservoir, Arkansas River, are discussed. (Authors)

9470. Cunningham, E. B. 1966. ALBERTA'S TROUT STREAMS, VICTIMS OF CONFLICTING INTERESTS. Can. Audubon, 28(4): 123-126. Illus.; Biological Abstracts, 48(8): Abst. No. 36503. 1967.

The solution to the overall problem concerning the loss of trout-producing water in Alberta is a complex one. There is no total answer and certain losses of trout streams will have to be accepted under the excuse of progress. The use of a trout stream or its water for another purpose without its destruction would be progress in the true sense. Fishermen will have to accept the fact that water will be used for irrigation, power, domestic, and industrial purposes. They will have to accept the fact that roads must be built, land cultivated, cattle grazed and timber harvested. They must also accept the fact that landowners have the right to exclude people from their land. (Authors)

9471. Groot, C. 1965. ON THE ORIENTATION OF YOUNG SOCKEYE SALMON (Oncorhynchus nerka) DURING THEIR SEAWARD MIGRATION OUT OF LAKES. Behavior. Suppl. 14. vii+198 p. Illus. E. J. Brill: Leiden, Netherlands; Biological Abstracts, 48(8): Abst. No. 36964. 1967.

Several orientation systems seem to be indicated under experimental conditions which can account for the directed migration of sockeye smolts towards the outlet. Primarily celestial phenomena were important for direction finding. Strong indica-

tions were obtained that both the sun and the polarized light from the blue sky can be used for orientation. Since sockeye smolts migrate primarily during the twilight periods, an ability to utilize the polarized light from the blue sky would be biologically of great significance, especially since the polarization of the skylight is most pronounced during the twilight periods as compared with other times of the day. Without the availability of celestial phenomena, orientation in the expected direction was still evident in the majority of sockeye smolts. The reference cues used for this type-X orientation are unknown. Final acceptance of a non-celestial compass orientation must wait until the cues involved have been determined. Landmark orientation may play a role in combination with celestial and probably also with non-celestial orientation. Results suggest that more than one orientation mechanism can be used by sockeye smolts during their migration out of lakes. Indications were found for sun-compass orientation, polarized light orientation, type-X compass orientation and landmark orientation. The interpretation of the directional choices during the daylight hours are made more difficult by the occurrence of phototactic interference.

9472. Alverson, Dayton L., and Norman J. Wilimovsky (U.S. Fish and Wildlife Service, Seattle, Wash.). 1966. FISHERY INVESTIGATIONS OF THE SOUTHEASTERN CHUKCHI SEA. In: Environment of the Cape Thompson Region, Alaska, United States Atomic Energy Commission: Oak Ridge, Tenn. 843-860. Illus., Map; Biological Abstracts, 48(8): Abst. No. 37141. 1967.

A 3-phase ecological investigation was designed to provide information on the abundance and distribution of marine fauna in the Chukchi Sea: a gross survey of the benthic fauna of the region; a more detailed sampling of the area adjacent to the proposed excavation site; and a study of the pelagic fauna of the region. Distribution of the 52 fish species was related to temperature and salinity. Although the species list was dominated by far northern types, the Chariot collection contained 12 fish forms previously not known to occur north of Bering Strait. Echinoderms were the most dominant invertebrate form found. However, a wide variety of other invertebrates was collected. Physical parameters of the study and data pertaining to species abundance and distribution are tabulated. (Authors)

9473. Balon, Eugen K. (Lab. Rybarstva, Bratislava, Czecholslovakia). 1966. THE FISH POPULATION OF THE INUNDATED ARM OF THE DANUBE NEAR BRATISLAVA AND A DESCRIPTION OF TOXAPHENE POISONING. Biologia (Bratislava), 21(4): 295-307. Illus. Map. (Ger. and Russ. summ.); Biological Abstracts, 48(8): Abst. No. 37144. 1967.

The effect of high doses of the insecticide Toxaphene upon the fish population of the Danube arm near Bratislava is described. The composition of the fish population was determined and the number of individuals estimated. The lethal dose of Toxaphene was established at 0.2 ppm in the summer and 0.3 ppm in the winter. The ichthyomass of this arm of the river was established at 507 kg/ha. The ratio of predatory fish to the non-predatory species is 12.9. --J. Burnett.

9474. Besse, P., and P. de Kinkelin. 1965. ON THE EXISTENCE IN FRANCE OF PANCREATIC NECROSIS OF THE RAINBOW TROUT (Salmo gairdneri). Acad. Veterinaire France Bull., 38(5): 185-190. Illus.; Biological Abstracts, 48(8): Abst. No. 37146. 1967.

Although it has not yet been determined that this concerns "infectious pancreatic necrosis" of American authors, there is a possibility since the spawn were imported. The disease is of epizootic behavior, attacking young rainbow trout on which the major lesion is a necrosis of the aciform formations of the pancreas. (From auth. summ. transl.)

9475. Mironova, N.F. (Zool. Inst., Acad. Sci. USSR, Leningrad, USSR). 1966. POSSIBLE RATE OF INCREASE IN THE NUMBER AND TOTAL BIOMASS OF Tilapia mossambica Peters. Dokl Akad Nauk SSSR 166(4): 968-969; Biological Abstracts, 48(8): Abst. No. 37163. 1967.

The author investigated the increment in weight of 2 pairs of Tilapia mossambica

and their offspring during a period of 8 months. The study revealed that with the cultivation of less than 1/4 of the offspring, the initial weight of the 2 pairs of fishes increased by a factor of 224 during the 8 months. This high potential possibility of the increase in population and total biomass of T. mossambica, even under aquarium conditions, is of interest in connection with the use of this species to combat fouling of hydraulic engineering structures by aquatic flora. --J. Slep.

9476. Smith, Howard D., Allyn H. Seymour, and Lauren R. Donaldson (Fish. Res. Board Can., Biol. Sta., Nanaimo, Brit. Columbia, Can.). 1966. THE SALMON RESOURCE. In: Environment of the Cape Thompson Region, Alaska, U.S. Atomic Energy Commission: Oak Ridge, Tenn. 861-876. Illus.; Biological Abstracts, 48(8): Abst No. 37183. 1967.

The number, distribution, and time of occurrence of salmon from Kotzebue Sound to Point Hope were assessed. Chum salmon were abundant in Kotzebue Sound. Pink salmon were common in the Kukpuk River at Point Hope. All 5 species of Pacific salmon common to this coast were found in the sea as far north as Cape Thompson, and they probably range at least as far as Point Hope. If ground-surface temperatures in the vicinity of Cape Thompson are rising, local stocks may increase. (Auth.)

9477. Morita, Yukitomo (Max-Planck-Ges., Bad Nauheim, West Germany). 1966. RESPONSE MODEL OF THE PINEAL NEURONS OF THE RAINBOW TROUT (Salmo irideus) DURING EXPOSURE OF THE MIDBRAIN TO LIGHT. Pflugers Arch Gesamte Physiol Mens Tiere 289(3): 155-167. Illus. (Engl. summ.); Biological Abstracts, 48(8): Abst. No. 38342. 1967.

Maintained activity in the absence of light was recorded from the exposured pineal organ (Epiphysis cerebri) of the rainbow trout (Salmo irideus) by means of microelectrodes. Inhibitory responses to light were obtained from pineal ganglion cells (single unit responses) as well as from the pineal tract (mass responses) of specimens deprived of their lateral eyes. The most sensitive units responded to white light of 1 sec duration at $3 . 10^{-5}$ lm/m^2 (mass responses) and with $7 . 10^{-5}$ lm/m^2 (single units). A still lower light threshold of $2.5 . 10^{-6}$ lm/m^2 was found when the lowermost steady illumination was determined which raised the dark threshold. During exposure to steady illumination the maintained activity decreases almost linearly with the logarithm of light intensity. A decrease of about 50% was obtained if the illumination was increased to 2,500 lm/m^2. The distribution of spectral sensitivity of the inhibitory effect of light varied among different pineal neurons. Curves exhibiting maxima between 500 and 533 mμ were seen. No Purkinje shift was observed during light adaptation. In some experiments inhibitory effects to short wavelengths and excitatory responses to long wavelengths were recorded (chromatic responses). (Auth.)

9478. Prazdnikov, E.V., and I.G. Mikhailova (Murmansk Mar. Biol. Inst., S.M. Kirov Kola Branch, Acad. Sci. USSR, Murmansk, USSR). 1965. SOME PROTECTIVE TISSUE REACTIONS OF HUMPBACK SALMON EMBRYOS. Dokl Akad Nauk SSSR, 164(5): 1194-1196. Illus.; Biological Abstracts, 48(8): Abst. No. 39141. 1967.

The reactivity of the tissues of the caudal stalk of embryos of humpback salmon was studied in response to the introduction of sterile cotton thread with carmine and of threads, "infected" with a day-old culture of the hay bacillus (Bacillus subtilis). In the first minutes and hours after the injury, the wound channel is mechanically compressed by the muscles. The deposition of the administered foreign particles in the region of the wound channel was incomplete--granules of carmine and the hay bacillus penetrated into the inter-tissue clefts at some distance from the wound channel. The developing local-inflammatory edema and swelling of the tissue elements to a certain extent localized the action of the injuring agent. The delimiting of the foreign particles, the phagocytosis of the foreign particles and microorganisms in the focus of injury is effectuated chiefly due to epithelial regeneration, although altered connective tissue elements and also blood leucocytes are also capable of phagocytosis. The regenerating tissues at the late stages of development of inflammation are readily injured and prove to be gateways for the penetration of microorganisms from the external medium, which in a number of cases leads to the infection and perishing of the embryos. --D. Franklin

9479. Grabda, Eugeniusz (Coll. Agr., Olsztyn, Poland). 1965. CURRENT STUDIES ON THE CONTROL OF PARASITIC DISEASES OF FISHES. Wiad Parazytol., 11(1-2 Suppl.): 323-329. (Engl. summ.); Biological Abstracts, 48(8): Abst. No. 41121. 1967.

A critical review of the practical achievements in the control of the most important parasitic diseases of fishes in Poland is presented. Current problems include studies on the bioecologic, physiologic and pathologic phenomena mainly concerning infections with Ichthyophthirius, Diplostomum spp., Ergasilus spp., Ligula spp., and Coccidia, introduction of new drugs, and drawing up a program of the control of economically important diseases. --Courtesy NSF (PL 83-480) 1966.

9480. Tiainen, O. A. (Coll. Veterinary Med., Helsinki, Finland). 1966. Diplostomum METACERCARIAE (TREMATODA, DIPLOSTOMATIDAE) AS PARASITES IN THE EYES OF TROUT AND BURBOT IN FINLAND. Ann. Zool. Fennici, 3(3): 173; Biological Abstracts, 48(8): Abst. No. 41145. 1967.

Blindness caused by metacercariae of the trematode Diplostomum spathaceum was observed among 1-year-old rainbow trout in a fish hatchery in South Finland. A considerable proportion of burbot caught during the winter of 1966 in the Gulf of Finland had a similar eye disease caused by metacercariae of Diplostomum clavatum. (Auth.)

9481. Lohnisky, Karel (Zool. Dept., Reg. Mus., Hradec Kralove, Czechoslovakia). 1966. THE SPAWNING BEHAVIOR OF THE BROOK LAMPREY, Lampetra planeri (Bloch, 1784). Vestnik. Cesk. Spolecnosti Zool., 30(4): 289-307. Illus. Map; Biological Abstracts, 48(9): Abst. No. 42129. 1967.

Though the spawning of the brook lamprey, Lampetra planeri (Bloch, 1784) was observed earlier by a number of authors, the data on the behavior of males and females are contradicting. To make the knowledge on the behavior of both sexes more precise and complete, the author observed spawning in 3 localities in the river Orlice basin (the Elbe system, north-east Bohemia) during the years 1963 to 1964 and in an aquarium in 1964. The spawning nests in the form of egg-shaped holes are excavated in shady shallows in streams at the beginning only by specimens of the sex prevailing in the locality. At the beginning the sand is stirred up from the bottom of the little holes, then small stones are moved from the hole downstream. The spawning act is begun by the male that approaches the female from above and attaches himself to her between the eyes, not farther than above the last pair of the branchial opening. The male winds his body round the female and the pair shake violently for 2 to 3 sec. The spawning act is finished by the male that releases the female and they both adhere to the bottom of the nest for 10 to 20 sec. Then the pair swim for 30-120 sec. about the nest excavating it. A spawning cycle of one female lasts 30 min. to 1 hr., the male then swims off and the female remains in the nest excavating it. In cases where there were more specimens in the nest during the spawning, the female spawned only after one single male had attached to her. Neither milt nor spawn were observed in nature and in the aquarium during the spawning. A few cases of exceptional behavior of both sexes are also described. (Auth.)

9482. Ovchinnikov, V. V. 1964. THE FISH FAUNA COMPOSITION OF THE GULF OF MEXICO AND SOME QUESTIONS CONCERNING ITS ORIGIN. Tr Atlanticheskogo Nauch-Issled Inst Rybn Khoz Okeanogr 11. 12-20. From: Ref. Zh., Biol., 1966, No. 11169. (Translation); Biological Abstracts, 48(9): Abst. No. 42228. 1967.

The fish fauna was studied from Nov. 1962 to Jan. 1963. About 150 species of fish belonging to 63 families were found. Various species of carangids, snappers, Sparidae, and pomadasyids have been observed in the southern part of the bay, and various species of clupeoids, carangids and snappers in the eastern part. Clupeoids and drums were widely represented in the northern part. Eight species of fish--Sardinella anchovia, Opistonema oglinum, Selar crumenophthalmus, Vomer setipinnis, Chloroscombrus chrysurus, Lutianus aya, L. synagris, Calamus arctifrons--occurred all over the Gulf of Mexico shelf during the period in question.

The discontinuous distribution of the fishes was caused by ecological and geographic factors as well as paleogeographic conditions prevalent in the West Indies during early geological periods. The composition of the fish fauna is markedly influenced by the warm Gulf Stream waters.

9483. Vincent, Bernard, and Francois Guibert. 1964. POSSIBILITIES OF SPORT FISHING UNDER ICE IN THE LARGE LAURENTIDES LAKES (CANADA). Quebec Serv. Faune Rapp., 3. 287-291. Illus. Map; Biological Abstracts, 48(9): Abst. No. 42247. 1967.

9484. Wicklund, Robert (Sandy Hook Marine Lab., Highlands, N. J.). 1966. BLACKFISH FEEDING STATION. Underwater Naturalist, 3(4): 22-23.

Large numbers of blackfish, Tautoga onitis, were observed during the summer of 1965 alongside a can buoy marking the inshore area of Shrewsbury Rocks, New Jersey. As many as 200 fish were observed feeding on the rich growth of mussels, Mytilus edulis. Mussel colonies are reduced from 18-inch layers to 6-inch layers during the summer. Blackfish apparently visit the buoy only to feed; they seek protection in the rocks several hundred yards away. --R. W. Topp.

9485. Waldbauer, Eugene C. (Dept. Biol., Univ. New York, Cortland, N. Y.). 1966. POSTING ON PRIVATE LANDS IN NEW YORK STATE. New York Fish & Game Jour., 13(1): 1-78. Maps; Biological Abstracts, 48(9): Abst. No. 42269. 1967.

A survey of the nature, extent and reasons for the posting of private lands against trespass for hunting and fishing was made during the years 1962, 1963, and 1964. The work was done chiefly in upstate New York, and a more general survey was made on Long Island because of the radically different conditions there. A summary of the history of the posting problem in the State and legislation relating to it is also given. In the upstate area towns having a population of less than 150 per square mile were primarily considered. A random sample of 100 such towns, apportioned among the State Conservation Department's administrative regions according to relative hunting pressure, was selected. The survey was divided into two parts. Phase I was a non-interview approach during which the roads in each town were traversed by a conservation officer who recorded specified information for each parcel of posted land he encountered. During Phase II randomly selected owners of posted parcels in each town, representing different types of ownership, were interviewed regarding their motives for posting and other aspects of the problem. There were 764 towns in upstate New York with a population of less than 150 per square mile. They constituted 84.1% of the total area. The 100-town sample comprised 3,230,694 acres or 12.1% of the area of the 764 towns, and 2,668,114 acres, or 82.5% of it, were private lands. There were 4,176 parcels of posted land recorded during Phase I of the survey, and 361 owners of posted land were interviewed during Phase II. The data indicated that 26 % of the area in private ownership was posted. The degree of posting was greatest in the vicinity of the large cities and related suburban areas. Of the posted parcels recorded, 3,393 (81%) were posted by the actual owner, while 783 (19%) were posted by second-party owners. Only 58% of the parcels were legally posted, absence of names and addresses on the posters being the most frequent violation. (Auth.)

9486. Turdakov, A. F. (Kirgiz SSR Acad. Sci. Ichthyol. Lab., Frunze, USSR). 1965. EFFECTS OF ROE SUBSTANCES AND OVARIAN FLUID ON FISH SPERMATOZOIDS. Vop. Ikhtiol., 5(2): 302-314; Biological Abstracts, 48(9): Abst. No. 42888. 1967.

Results of studies on several species of Leuciscinae, Schizothoracinae, Cyprinus carpio L., Nemachilus strauchi ulacholicus Anikin, etc., (all from the Issyk-kul') are presented along with a review of existing literature to clarify the interaction between spermatozoids and ovarian fluid or roe matter. Three groups of spermatozoids are identified (i.e. those inactive in ovarian fluid, those initially inactive but intensifying their activity as time passes, and those in active motion).

An immobilizing effect on spermatozoid activity is attributed to the high viscosity of ovarian fluid. Gynogamore I is discussed as the principle activating spermatozoids, though its chemical composition is unclear, evidence is presented to negate the suspected relationship between the level of fertilizability and the intensity of carotinoid pigmentation. The longer span of spermatozoid mobility in ovarian fluid is attributed to its more favorable ion composition (as compared to lake water) and to the osmotic pressure factor rather than to effects of gynogamone I it contains. The agglutination of spermatozoids is discussed in relation to the dilution ratio of running water to egg fluid (water containing roe). Reports by Japanese researchers are cited in discussing the behavior of spermatozoids at the micropyle during fertilization. Heteroagglutination and the fertilizing capability of spermatozoids are briefly discussed and specific recommendations are made as to best procedures for artificial insemination. --B. Le Bental.

9487. Sathyanesan, A.G. (Dept. Zool., Banaras Hindu Univ., Varanasi, Uttar Pradesh, India). 1966. THE STRUCTURE OF THE GLOMERULAR CYSTIC TUMOR PRESENT IN THE TROPICAL FRESHWATER CATFISH, Mystus vittatus (Bloch). Trans. Amer. Microscop. Soc., 85(1): 53-57. Illus.; Biological Abstracts, 48(9): Abst. No. 44167. 1967.

The histological structure of the glomerular cystic tumor in the tropical freshwater teleost, Mystus vittatus, is described. The initial stage in the formation of the tumor is marked by the appearance of cystic spaces or infiltration of lymphoidal cells. A degenerating cyst is characterized by the presence of an extensive cavity with varying quantities of stainable debris and sparsely scattered nuclei. Some cysts exhibit a tendency to metastisize. (Auth.)

9488. Zenner, H. (Zool. Inst., Univ. Köln, Cologne, West Germany). 1965. INVESTIGATIONS ON THE MORPHOGENETIC EFFICACY OF Li^+ IONS IN THE EMBRYONIC DEVELOPMENT OF RAINBOW TROUT (Salmo irideus Gib.). Biol. Zentralbl., 84(2): 139-179. Illus.; Biological Abstracts, 48(9): Abst. No. 44473. 1967.

During cleavage, tissue and organ specific defects can be induced including chordal reduction, connective tissue degeneration of somites, and hypertrophy of endodermal organs. Central nervous system defects are obtained by treating gastrulae. Hypomorphism of the head region may result. The osmotic pressure apparently plays a subordinate role in causing a primary defect in inductive systems which cause secondary anomalies. Cleavage and morula stages are especially Li-sensitive. Next on the basis of lethality and deformity are gastrula and neurula, regulation involves strength of solution and length of exposure. Cell division is arrested either through nonspecific physico-chemical change in the protoplasm or damage to oxidative metabolism, or else specific inhibition of purine synthesis is involved. --D. Grosch.

9489. Platzer, Edward G., and James R. Adams (Dept. Zool., Univ. Mass., Amherst, Mass.). 1967. THE LIFE HISTORY OF A DRACUNCULOID, Philonema oncorhynchi, IN Oncorhynchus nerka. Can. J. Zool., 45(1): 31-43. Illus.; Biological Abstracts, 48(9): Abst. No. 46469. 1967.

The life cycle of Philonema oncorhynchi was studied by infecting Cyclops bicuspidatus with larvae obtained from gravid female worms in spawning salmon and by subsequent infection of hatchery-reared salmon fingerlings. Later development of the worms was observed in naturally infected fingerling sockeye salmon maintained in fresh water for 2 years. Development to an infective third larval stage in the hemocoele of copepods was completed in 17 days at 12°C and in 70 days at 8°C. Third-stage larvae were obtained from peritoneal tissues of fish and tunica adventitia of the swim bladder 4 to 10 days after infection. In naturally infected fish, fourth-stage larvae were found in the peritoneal tissues when the fish were 26 months old. They moved into the coelom when the fish were 32 months old and molted to the subadult stage. Visceral adhesions developed in the infected fish at this time. The authors discuss the relationship of the life cycle of the worms to the 4-year life cycle of its anadromous host and advance the hypothesis that reproduction in the worm is correlated with that of the host by the latter's hormones. (Authors)

9490. Springer, Stewart, and Mary H. Wagner (U.S. Fish and Wildlife Service, Stanford, Calif.). 1966. Galeus piperatus, A NEW SHARK OF THE FAMILY SCYLIORHINIDAE FROM THE GULF OF CALIFORNIA. Los Angeles County Mus. Contrib. Sci., 110. 1-9. Illus.; Biological Abstracts, 48(9): Abst. No. 46812. 1967.

Three specimens trawled from a depth of approximately 275 m midway between Tiburon and Angel de la Guardia Islands in the Gulf of California, the only known specimens of the genus Galeus from the eastern Pacific, constitute the type series of a new sp., piperatus, which is described and illustrated.

9491. Hoffman, G. L. (Bur. Sport Fisheries and Wildlife, Kearneysville, W. Va.). 1967. PARASITES OF NORTH AMERICAN FRESHWATER FISHES. Univ. Calif. Press, Berkeley, 486 p. Pr. $15.00.

This is a review of the parasites of North American freshwater fishes. Its purpose is to aid the student, diagnostician, or researcher in identifying the parasites and finding the published accounts of them. The following taxons are considered: Algae, Fungi, Protozoa, Helminthes, Parasitic Copepoda, Parasitic Mites, Glochidia, Sphaerid Clams, Linguatula and Predators. The principal part is set up as follows: (1) Identification keys to the larger groups, finally to most of the genera, and rarely to species. In some instances no further aid is necessary, but where needed, the references should steer the reader to the appropriate literature. (2) Representative species of each genus are illustrated (252 drawings). (3) The higher taxa, down to the genera, are described. (4) The species lists contain references to nearly all the published literature so that the reader can become aware of previous work done on morphology, taxonomy, life cycles, pathogenicity, physiology, and disease treatment. An extensive host-parasite list is included. Also included are sections on public health, methods of studying fish parasites, some parasites listed by location in the fish, fish parasites found on or in other animals, and predators. The bibliography of 1,284 entries is as complete as possible, including reference to the original describers of the genera and species. The index is general and taxonomic with all of the species listed under the respective genera.

9492. Wicklund, Robert (Sandy Hook Marine Lab., Highlands, N. J.). 1966. SEA LAB POWERFUL ATTRACTION TO FISH. Underwater Naturalist, 3(4): 23-25.

During the summer of 1965 large numbers of fishes were attracted by the U.S. Navy's Sea Lab II, planted at a depth of 205 ft. on the Pacific continental shelf near the edge of Scripps Submarine Canyon, 2,000 yards west of the Scripps institution pier at La Jolla, California. The fish population grew rapidly from a few scattered fish on the first day to an estimated 6,500 fish by the 44th day. The attractive power of the structure was thought to be due to the lights which attracted planktonic life and small fish. Larger fish and a sea lion gathered to forage on these smaller forms. --R. W. Topp.

9493. Mokryak, T.S. 1958. OBSERVATIONS ON ENTRY OF FISH INTO THE FISH LIFT OF THE TSIMLYANSKOE DAM. Nauchn.-Tekh. Byul. Vses. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 6/7. 13-18; Ref. Zh., Biol., 1960, No. 55991. (Translation); Biological Abstracts, 48(10): Abst. No. 47523. 1967.

The flow, regulated by a special tube, was the main means for attracting the fish into the lift. The largest batches raised by one sluicing were 4-6 tons; the smallest consisted of only a few individuals. More than 20 fish species entered the lift. The number of fish entering depends on the velocity of flow in the trough of the life, the greatest number of fish of all species enter the lift at a velocity of 0.5 m/sec; at 0.3 m/sec, small fish aggregate in the lift. Wild carp, Pelecus cultratus, silver bream Blicca bjoerkna, Vimba vimba, and Lucioperca lucioperca, enter the lift at all hours of the day. Abramis ballerus and Silurus glanis enter at night, Acipenseridae enter early in the morning, and Vimba vimba and Chalcalburnus chalcoides in the morning. Every year from Dec. 1-15, the fish begin to move downstream and they enter the turbines where they get macerated. A small number of diadromous fishes of the Don River enter the fish lift. Most Vimba vimba carinata Pall. and sturgeons Acipenseridae, enter the diversion channel of the hydroelectric station. --Courtesy NSF (PL 83-480) 1963.

9494. Tarkovskaya, O. I. 1958. METHODS OF STUDYING GENERAL METABOLISM IN FISH. Tr. Soveshch. Ikhtiol. Komis. Akad. Nauk SSSR 8. 232-236; Ref. Zh., Biol., 1960, No. 15675. (Translation); Biological Abstracts, 48(10): Abst. No. 47808. 1967.

A respiration chamber was specially constructed for the study of the general metabolism of fish. The chamber enables the determination of the use of proteins, fats, and carbohydrates for energy and metabolic exchanges. The chamber allows for free movement of the experimental fish and secures sufficient supply of O_2 during the entire experiment. The taking of water samples and removal of excrement does not disturb the fish. Oxygen was determined by Winkler's method, N with the micromethod of Conway, fat with the modified method of Bel'kovich, CO_2 with a mixture of cresol red and thymol blue, calories by the oxidation of organic matter with KIO_3. Introductory balance equilibrium experiments showed that at low temperatures (13-14°C) the feeding of carp fry-of-the-year with Chironomidae brings about excessive consumption of protein which is used for oxidation instead of being used for growth. When, under such conditions, boiled sorghum gruel is used, the protein supply is insufficient and body protein is used up, in spite of the fact that there is a supply of N-free substances sufficient for energy requirements. --Courtesy NSF (PL 83-480) 1963.

9495. La Roche, Gilles, C. L. Johnson, and A. N. Woodall (Marine Sport Fish. Lab., Univ. Rhode Island, Narragansett, R. I.). 1966. IODINE METABOLISM IN YOUNG CHINOOK SALMON (Oncorhynchus tschawytscha, Walbaum): I. THYROIDAL IMPAIRMENT WITH THE USE OF I^{131}. Gen. Comp. Endocrinol., 7(3): 512-524.

Six monthly or six weekly injections of 100 μc I^{131} (as carrier-free iodide) (total dose 600 μc/fish) produced a profound impairment of thyroid function in yearling chinook salmon. Thyroid region I^{131} contents, radioiodine turnover studies, and modifications in iodinated metabolite contents were the principal functional parameters examined. Histological examinations revealed that thyroid follicle destruction was not accompanied by an arrest of thyroxine synthesis. Preliminary microscopic and biochemical evidence also indicates that thyroid epithelial cell integrity is not a condition essential for thyroxine biosynthesis. At least 9 months after the disappearance of thyroid follicles detectable levels of thyroxine were produced. This amount appeared sufficient to maintain growth at a rate indistinguishable from that of controls. None of the peripheral changes described for young I^{131}-treated rainbow trout were observed in young chinook salmon in spite of highly significant decreases in thyroid region I^{131}. It was concluded that I^{131} destruction of functional thyroid elements is more difficult to achieve in the yearling chinook salmon than in the rainbow trout of the same age. (Authors)

9496. Copeland, B. J. (Inst. Mar. Sci., Univ. Tex., Port Aransas, Texas). 1966. EFFECTS OF INDUSTRIAL WASTE ON THE MARINE ENVIRONMENT. Water Pollut. Contr. Federation, 38(6): 1000-1010. Illus., Map. (French, Ger., Port., and Spanish summ); Biological Abstracts, 48(10): Abst. No. 50336. 1967.

Phosphate-phosphorus, Ohle anomalies, redox potential, species diversity, salinity, alkalinity, and chlorophyll-a were measured in St. Joseph's Bay, Florida. Toxicity bioassays of several Texas industrial wastes were conducted, and community metabolism of 3 industrial effluents was measured. Effects of long periods of effluent retention were evaluated. High phosphorus concentrations, reducing Ohle anomalies and redox potential, and low species diversity in St. Joseph's Bay indicated some degree of organic pollution. Although some industrial effluents did not kill 50% of the fish, they caused a dicided increase of the fish's metabolic rates. Long periods of retention allowed biological communities in industrial effluents to stabilize to the point of balance. (Auth.)

9497. Geldreich, Edwin E., and Norman A. Clarke (Robert A. Taft Sanit. Eng. Center, Cincinnati, Ohio). 1966. BACTERIAL POLLUTION INDICATORS IN THE INTESTINAL TRACT OF FRESHWATER FISH. Appl. Microbiol., 14(3): 429-437; Biological Abstracts, 48(10): Abst. No. 50341. 1967.

A study was made of the occurrence, distribution, and persistence of coliforms, fecal coliforms, and fecal streptococci in the intestinal tract of freshwater fish. A total of 132 fish representing 14 different species were used in various phases of these experiments. Examination of the intestinal contents of 78 fish from moderately polluted sections of the Little Miami River indicated that fecal coliform densities were lowest in bluegills (less than 20/g) and highest in catfish (1,090,000/g). Levels of fecal streptococci for these 2 species were 220 and 240,000/g, respectively. The occurrence of fecal coliforms in fish caught in this stream reflected the warm-blooded-animal-pollution level of the water. All fish used in this phase of the study were caught during July, Aug., and Sept. when the water temperatures were between 13°and 18° C. The fate of fecal coliforms and Streptococcus fecalis in the fish intestine indicated that these organisms can probably survive and multiply when fish and water temperatures are 20° C or higher, but only when the organisms are retained in the gut for periods beyond 24 hours. Based on the biochemical reactions for 3,877 coliform strains isolated from 132 freshwater fish of 14 different species, 91.4% of all strains were composed of 5 IMViC types. In a similar study of the biochemical reactions of 850 streptococci isolated from the intestinal tract of 55 freshwater fish, the predominant strains included S. fecalis and various closely associated biotypes. No consistently recurring pattern for either coliforms or streptococci could be developed to identify species of fish investigated. The composition of the intestinal flora is, however, related in varying degree to the level of contamination of water and food in the environment. (Authors)

9498. Von Windeguth, Donald L., and R.S. Patterson (Florida State Board of Health, Winter Haven, Fla.). 1966. THE EFFECTS OF TWO ORGANIC PHOSPHATE INSECTICIDES ON SEGMENTS OF THE AQUATIC BIOTA. Mosquito News, 26(3): 377-380; Biological Abstracts, 48(10): Abst. No. 51862. 1967.

Neither fenthion nor Abate was toxic to fish at a dosage rate necessary to control the larvae of the chironomid midge Glyptotendipes paripes. Fenthion was toxic to the shrimp Palomonetes paludosus and amphipods Hyalella azteca at a dosage of 11 ppb which is below the level for chironomid larvae however, in the field enough of the shrimp and amphipods were able to survive the fenthion applications to repopulate the lakes. Microcrustacea and protozoa were not affected by the dosage rate required to control midge larvae. Abate at 0.1 ppm was safe to all of the organisms tested. (Authors)

9499. Kirpichnikov, V.S. (Res. Inst. Lake River Fish., Leningrad, USSR). 1966. EFFICIENCY OF MASS SELECTION AND SELECTION FOR RELATIVES IN FISH CULTURE. Genetika, 4. 16-25. Illus. (Engl. summ.); Biological Abstracts, 48(11): Abst. No. 52460. 1967.

Good choice of methods for scientific fish selection is very important. Efficiency of mass selection depends on intensity of selection, variability of fish and heritability of selective characters. Due to the high fertility of fish the intensity of mass selection is 2-3 times higher than that of selection for relatives. Individual variability is also higher than mean family variability. The heritability of such important characters as body weight is not high but it may be increased by crossings and environment leveling. In pond fisheries, selection for relatives is more advantageous than mass selection only when heritability of selective characters is very low ($h^2 < 0,1$-0.15), The best way is to apply combined selection i. e. successive carrying out of mass selection, progenytesting and family selection in the same generation. (Auth.)

9500. Hunn, J.B., and P.O. Fromm (Fish Control Lab., U.S. Fish and Wildlife Service, La Crosse, Wisc.). 1966. IN VIVO UPTAKE OF RADIOIODIDE BY RAINBOW TROUT. Water Pollut. Contr. Federation J., 38(12): 1981-1985.

Rainbow trout were exposed to sodium radioiodide (NaI^{131}) in distilled water, tap water, 0.6-percent NaCl, and dilute fish Ringer's solution for 24 hours. Samples of blood, heart, gill, lower jaw, liver and gall bladder, spleen, pyloric caeca, head kidney, posterior kidney, intestine, stomach, skeletal muscle, and eye were taken and the I^{131} content of the tissues was determined. Only the lower jaw (thyroid) concentrated iodide above the blood level. I^{131} uptake was not affected

by the osmotic gradient between the fish and the medium, but was inversely related to the calcium concentration of the medium. Sodium thiocyanate inhibits I^{131} uptake by the gills and blocks thyroidal uptake. (Authors)

9501. Porcella, D.B., and A.G. Friend (R.A. Taft Sanit. Eng. Center, U.S. Public Health Service, Cincinnati, Ohio). 1966. FIELD STUDIES OF SPECIFIC RADIONUCLIDES IN FRESH WATER. Water Pollut. Contr. Federation J., 38(1): 102-110. Illus.; Biological Abstracts, 48(11): Abst. No. 52642. 1967.

Higher concentrations of Sr^{90}, Cs^{137}, and chemically similar radioisotopes are found in fish in Lower Three Runs than in fish in the Clinch River, Tennessee. Cs^{137} is adsorbed on illitic clays in the Clinch River. The $(Sr^{90}/(Ca+Sr))$ ratio, 10 times greater in Lower Three Runs than in the Clinch River, caused Sr^{90} levels 5.1 times greater in bones of Lower Three Runs largemouth bass. Cs^{137} concentration was 45 times greater in Lower Three Runs fish flesh than in Clinch River fish flesh. Differences in species, tissue, and life history were factors in influencing radioisotope levels in individual fish. (Authors)

9502. Carlson, Dale R. (Worthington State Jr. Coll., Worthington, Minn.). 1967. FATHEAD MINNOW, Pimephales promelas Rafinesque, IN THE DES MOINES RIVER, BOONE COUNTY, IOWA, AND THE SKUNK RIVER DRAINAGE, HAMILTON AND STORY COUNTIES, IOWA. Iowa State J. Sci., 41(3): 363-374. Illus.; Biological Abstracts, 48(11): Abst. No. 52846. 1967.

Fathead minnows were collected in the latter half of June and in July from 3 locations in the Desmoines River, Boone County, Iowa, in 1965 and from 21 locations in the Skunk River drainage in Hamilton and Story counties in 1966. Indications are that peak spawning takes place during the middle and latter part of July or later. Most larger fathead minnows are males. The sex ratio is essentially 1:1. Annulus formation took place during the middle and latter part of July. A higher percentage of fathead minnows were classified as Age II than reported for pond and lake populations. A single length-weight relationship changed during the summer. (Auth.)

9503. Copeland, B.J. (Univ. Tex., Inst. Mar. Sci., Port Aransas, Texas). 1966. EFFECTS OF DECREASED RIVER FLOW ON ESTUARINE ECOLOGY. Water Pollut. Contr. Fed. J., 38(11): 1831-1839. Illus. (French, Ger., Port., and Spanish summ.); Biological Abstracts, 48(11): Abst. No. 52861. 1967.

A survey of the literature shows that high salinity, which results from low input of fresh water, can cause far-reaching changes in the ecology and productivity of an estuary. High salinities may cause the multiplication of parasites and species competing with oysters, damage to the nutritional requirements of shrimp, lessening of reproduction of the blue crab, lowering of primary productivity, and upset of the life cycles of fish. The effects of regulating river flow by dams on the ecology of estuaries should be considered carefully. (Auth.)

9504. Sultamuratov, M. 1965. CARP CULTURE IN THE RICE STATE FARM "MAIYAB". Vestnik Karakalpakskogo Filiala Akad. Nauk. UZ SSR 220. 9-13. From: Ref. Zh., Biol., 1966, No. 21190. (Translation); Biological Abstracts, 48(11): Abst. No. 52926. 1967.

Carp yearlings were reared in unplanted rice fields with a total area of 10 ha. The stocking rate of yearlings varied from 765 to 5,658 specimens/ha. During the growing period the fish were fed cottonseed oil cake (30%) and concentrates (70%). The amount of food required to produce an increase in weight of 1 kg varied from 2.8 to 6.3 kg. In spring, when the fields were drained completely their average production was 631 kg/ha of carp with an average weight of 370 g. With a stocking rate of 2,540 specimens/ha and with supplementary feeding, fish productivity was of the order of 10 metric centners/ha. In addition to rice fields, there are in Karakalpak many natural bodies of water suitable for fish breeding.

9505. Yeo, R.R. (Dept. Botany, Univ. Calif., Davis, Calif.). 1967. DISSIPATION OF DIQUAT AND PARAQUAT, AND EFFECTS ON AQUATIC WEEDS AND FISH. Weeds, 15(1): 42-46. Illus.; Biological Abstracts, 48(11): Abst. No. 56708. 1967.

Rates of dissipation of 6,7-dihydrodipyrido [1,2-a:2', 1'-c] = pyrazidiinium salt (diquat) and 1,1'-dimethyl-4,4'-dipyridinium salt (paraquat) in water were studied from 1963 to 1965 at Davis, California. Effects of several environmental factors on dissipation of the herbicides, and herbicidal control of 9 to 14 aquatic weeds and toxicity to three kinds of fish and an Asiatic clam also were investigated. Small amounts of the herbicides were still detectable in water at the end of 12 days. In reservoirs, diquat applied at 1000 ppbw or less dissipated to 9 ppbw or less. In growth pools, a concentration of 4000 ppbw dissipated to between 600 and 900 ppbw. Dissipation of paraquat in reservoirs was slower than diquat and exhibited unpredictable fluctuations in amounts present. When 250 to 2500 ppbw of paraquat were applied in reservoirs, 0 to 180 ppbw remained after 13 days. In growth pools, 80 to 300 ppbw of paraquat persisted on the 12th day after applications of 1000 to 3000 ppbw. (Auth.)

9506. Ferguson, Denzel E., Daniel T. Gardner, and Ancil L. Lindley (Miss. State Univ., Zool. Dept., State College, Miss.). 1966. TOXICITY OF DURSBAN TO THREE SPECIES OF FISH. Mosquito News, 26(1): 80-82; Biological Abstracts, 48(11): Abst. No. 56798. 1967.

The organic phosphorus insecticide (O,O-diethyl 0-3, 5, 6-trichloro-2-pyridyl phosphorothioate) was less toxic to golden shiners, mosquito fish, and green sunfish than most chlorinated hydrocarbon insecticides but more toxic than most phosphate insecticides. Fish from populations knows to be resistant to several chlorinated hydrocarbon insecticides were more tolerant of Dursban than were the same species from insecticide-free environments. (Authors)

9507. Behmer, David J. (Iowa State Univ., Ames, Iowa). 1965. MOVEMENT AND ANGLER HARVEST OF FISHES IN THE DES MOINES RIVER, BOONE COUNTY, IOWA. In: Proc. 75th Session Iowa Acad. Sci., Decorah, 17-18 April, 1964, The State of Iowa: Des Moines.; Proc. Iowa Acad. Sci., 71: 259-263; Biological Abstracts, 48(12): Abst. No. 58097. 1967.

Fish tagging returns of the Iowa Cooperative Fisheries Research Unit from 1955 to the end of 1963 are summarized. Tag returns give minimum estimates of angler harvest as 4.6% for channel catfish, Ictalurus punctatus, and 12.0% for walleyes, Stizostedion vitreum. Very few flathead catfish, Pylodictis olivaris, and smallmouth bass, Micropterus dolomieui, were reported caught by anglers. Channel catfish showed greatest movement of the species studied with downstream movement predominating. Walleyes moved as far as 18 miles. Smallmouth bass showed very little movement, except for one individual that moved about 40 miles. Data on both angler harvest and movement must be interpreted in the light of biases inherent in the study. (Auth.)

9508. Thompson, J. Douglas (Iowa Agr. and Home Econ. Exp. Sta., Ames, Iowa). 1965. AGE AND GROWTH OF LARGEMOUTH BASS IN CLEAR LAKE, IOWA. In: Proc. 75th Session Iowa Acad. Sci., Decorah, 17-18 April, 1964, The State of Iowa: Des Moines. Proc. Iowa Acad. Sci., 71: 252-258. Illus.; Biological Abstracts, 48(12): Abst. No. 58161. 1967.

Age and growth of 281 largemouth bass, Micropterus salmoides, collected from Clear Lake during the years 1947 through 1963 were determined by the scale method. The body-scale relationship had an intercept of 1.00 inch in total length. The weight increased as the 3.091 power of the length and a slight increase in average condition was found for fish from 15 to 20 inches in length. The growth curve was somewhat above the median of 30 curves reported for other waters. Lee's phenomenon was not evident, suggesting sampling was not size selective. All year classes, 1943 to 1962, were included in the sample. Annual growth was correlated with water level but with neither temperature nor turbidity. (Auth.)

9509. Pfitzner, Ingrid (Robert Koch Inst., Berlin, Germany). 1966. CONTRIBUTION TO THE ETIOLOGY OF "HEMORRHAGIC VIRAL SEPTICEMIA OF RAINBOW TROUT". Zentralbl Bakteriol. Parasitenk Infektionskrankheiten Hyg Abt I Orig., 201(3): 306-319. Illus. (Engl., French, and Spanish summ.); Biological Abstracts, 48(12): Abst. No. 60526. 1967.

From Bavarian rainbow trout with "hemorrhagic viral septicemia" organ extract and whole fish extract were obtained for infection experiments. For the demonstration of virus, tissue cultures were grown from the gonads (ovaries) of Tinca vulgaris CUV. (tench), and Cyprinus carpio L. (carp). Infection experiments from animals with this trout virus were successful in the goldfish Carassius auratus gibelio (Bloch). The diseased fish were added to the tissue cultures in the form of whole fish extract. On the average, cytopathogenic effects occurred in the tissue cultures 1 to 3 days after infection with the various materials. (From auth. summ.)

9510. Merrell, John C., Jr., and Albert Katko (Santee Recreation Project, San Diego, Calif.). 1966. RECLAIMED WASTEWATER FOR SANTEE RECREATIONAL LAKES. J. Water Pollut. Contr. Fed., 38(8): 1310-1318. Illus. (French, Ger., Port., and Spanish summ.); Biological Abstracts, 48(12): Abst. No. 61121. 1967.

The Santee County Water District in southern California operates a system of recreational lakes for which treated wastewater is the principal supply. After activated sludge treatment and detention in an oxidation pond, effluent percolated through a shallow natural aquifer is chlorinated before entering the lake system. Bacteriological and virological quality of the lakes has been satisfactory. Recreational uses of the reclaimed water include boating, fishing, and swimming. The lakes have developed a reasonably well-balanced ecological system, although eutrophication has become a problem. The area appears to have great aesthetic appeal. (Authors)

9511. Yeo, R.R. (Dept. Botany, Univ. Calif., Davis, Calif.). 1967. SILVER DOLLAR FISH FOR BIOLOGICAL CONTROL OF SUBMERSED AQUATIC WEEDS. Weeds, 15(1): 27-31. Illus.; Biological Abstracts, 48(12): Abst. No. 61713. 1967.

Two fish from South America (Metynnis roosevelti Eigenmann and Mylossoma argenteum E. Ahl.), both called silver dollar fish, grazed rapidly on several species of submersed aquatic weeds. Horned pondweed (Zannichellia palustris L.), American pondweed (Potamogeton nodosus Poir.), and sago pondweed (Potamogeton pectinatus L.) were most palatable to the fish. Richardson pondweed (Potamogeton richardsonii (Ar. Ben.) Rydb.), curlyleaf pondweed (Potamogeton crispus L.), and American elodea (Elodea canadensis Michx.) also were grazed. The fish readily grazed on shoots of all sizes except those of mature plants. The Mylossoma grazed the plants more rapidly than the Metynnis. When water temperatures were above 70° F, the fish became more active in their feeding habits. (Auth.)

9512. Bardach, John. 1966. DOWNSTREAM: A NATURAL HISTORY OF THE RIVER FROM ITS SOURCE TO THE SEA. ix+278 p. Illus. Universal Library, Grosset and Dunlap: New York. Pr. $2.95; Biological Abstracts, 48(13): Abst. No. 63205. 1967.

This volume is the story of mountain brooks and waterfalls, of aquatic plants, fishes, and streamside birds and mammals. The effects of floods and summer dryouts, the workings of watersheds, the reasons behind different streamflow characteristics, water colors, and river shapes is described. Man's influence on the river environment, especially the new water conservation methods and the damaging effects of insecticides, detergents, atomic wastes, and other effluents that threaten this great resource is also evaluated.

9513. Fields, Paul E. 1966. FINAL REPORT ON MIGRANT SALMON LIGHT GUIDING STUDIES AT COLUMBIA RIVER DAMS. xvii+266 p. Illus. North Pacific Corps of Engineers: Portland, Oreg.; Biological Abstracts, 48(13): Abst. No. 63217. 1967.

This report represents a significant phase of study under the Corps of Engineers

Fisheries-Engineering Research Program. No single method has yet been devised to guide all of the fish successfully, but various combinations of guiding, disease and predator control, as well as design and operation of turbines and spillways may yet provide a practical solution that will sustain a profitable commercial fishery. The Corps of Engineers is seeking optimum fish passage through the turbines by studies of turbine blade design, and by establishing operating procedures that are safest for migrants. Various Federal and state fisheries agencies are concerned with the development of artificial spawning and rearing areas, and with disease and predator control to minimize the present 90 percent mortality from egg deposition to downstream migration. "Guidance" was assumed to have been effected whenever the total numbers of fish caught varied consistently with the light conditions used. If two light conditions were presented simultaneously so that the migrants had a "choice" between them, the condition associated with the greater catch was assumed to be the more effective. If the light conditions were tested on successive nights, a dark night "control" was instituted and tests were conducted over more nights, but the results were still presumed to be less decisive than those obtained with simultaneous choices. Light conditions associated with catches larger than those taken on dark nights have been described as "positive" or "attracting" stimuli, whereas those conditions associated with catches smaller than on dark nights have been called "negative" or "repelling" stimuli. Since the identical light bulb may attract migrants under some conditions and repel them under others, identification of these uncontrolled variables is an important research area.

9514. Tugarina, P. Ya., and E.S. Gomenyuk. 1965. THE FOOD OF GRAYLING IN THE IRKUTSK RESERVOIR. Izv. Biol. Geogr. Nauch-Issled Inst. Pri. Irkutskom Univ., 18(1/2): 70-83. From: Ref. Zh., Biol., 1966, No. 7I103. (Translation); Biological Abstracts, 48(13): Abst. No. 63234. 1967.

A characteristic component in the food of grayling of the Irkutsk Reservoir are algae. The stomachs of grayling of different ages contained nearly 30 food components belonging to 4 main groups: Amphipoda, Mollusca, insects and plants. The food spectrum of grayling is most variable in the spring-summer period; in the fall-winter period it is mainly represented by amphipods and larvae of water insects. The highest indices of fullness (100-200%) were recorded in June-Aug. No differences were observed between the food of males and females, and none among fish captured in different parts of the reservoir. If the maximum weight of the stomach contents is taken as the daily ration, then the annual food consumption of grayling of ages 3+ to 6+ will amount to 1-1.5 kg per individual, i.e., the food coefficient equals 5-10.

9515. Vasil'eva, N.E., and M.N. Mel'nikova. 1965. CHANGES IN THE INTESTINAL EPITHELIUM OF ATLANTIC SALMON (Salmo salar L.) DURING SPAWNING. Nauch. Dokl. Vyssh. Shkoly. Biol. Nauk., 4. 32-35; Biological Abstracts, 48(13): Abst. No. 63812. 1967.

The intestinal epithelium of Atlantic salmon was examined and compared with that of the river lamprey. During the spawning period, the surface of the mucous membrane becomes smooth in both species, and the height of the marginal cells diminishes. In Atlantic salmon these modifications are less well-developed; the epithelium lacks complexity, and there is only a slight displacement of the nuclei toward the apical cell surfaces. The surface of the intestinal epithelium lining is occupied by enlarged goblet cells. In its intestinal epithelium, as in that of the river lamprey, the number of leukocytes increases. Abrupt destructive modifications, such as are characteristic of the river lamprey which dies after spawning, do not occur in the Atlantic salmon's intestinal epithelium during the spawning period. In spent and river-overwintered Atlantic salmon, compensatory processes take place, as a result of which the intestinal structure returns to normal.

9516. Boehlke, K. W., O. W. Tiemeier, and B. E. Eleftheriou (Dept. Zoology, Kansas State Univ., Manhattan, Kan.). 1967. DIURNAL RHYTHM IN PLASMA EPINEPHRINE AND NOREPINEPHRINE IN THE CHANNEL CATFISH (Ictalurus punctatus). Gen. Comp. Endocrinol., 8(1): 189-192. Illus.; Biological Abstracts 48(13): Abst. No. 64326. 1967.

A study was made of norepinephrine and epinephrine in plasma of the channel catfish (Ictalurus punctatus) to determine if a diurnal variation occurred. Plasma was collected at midnight, 6 and 10 AM, and at 2 and 7 PM. Epinephrine exhibited no change during the 24-hour period studied. Norepinephrine, however, demonstrated a significant plasma concentration of 4.6± 0.5 μg/100 ml plasma at 2 PM and a second peak at midnight with a value of 2.7± 0.3 μg/100 ml. (Authors)

9517. Waldichuk, Michael (Biol. Sta., Fish. Res. Board, Nanaimo, British Columbia, Canada). 1966. EFFECTS OF SULFITE WASTES IN A PARTIALLY ENCLOSED MARINE SYSTEM IN BRITISH COLUMBIA. J. Water Pollut. Contr. Fed., 38(9): 1484-1505. Illus. Map; Biological Abstracts, 48(13): Abst. No. 66257. 1967.

Sulfite-mill wastes discharged into the inner basin of a series of shallow marine embayments in British Columbia depresses the DO (dissolved oxygen) by as much as 8 mg/l. Wastes are flushed from the basin chiefly by turbulent diffusion as a result of tidal action. Over 50% of the water is replaced in 2 and 3 tides, respectively, in the outer and inner basins, and 90% in 5 and 8 tides. The flux of DO is close to the daily oxygen demand of the mill wastes. DO was restored to normal concentrations during a week of mill shutdown and declined after resumption of production. A BOD (biochemical oxygen demand) loading of 14% of that imposed in July 1962 would allow adequate DO for fish life. (Auth.)

9518. Metcalf, Artie L. (Univ. Kansas, Lawrence, Kan.). 1966. FISHES OF THE KANSAS RIVER SYSTEM IN RELATION TO ZOOGEOGRAPHY OF THE GREAT PLAINS. Univ. Kans. Publications Mus. Natur. Hist., 17(3): 25-189. Illus.; Biological Abstracts, 48(13): Abst. No. 67613. 1967.

Seventy-one species of fishes thought to be native were observed from the Kansas River System. The presence of 7 species is known or believed to be entirely due to introduction by man. For 6 additional species, evidence is inconclusive as regards native occurrence. There are records in the literature of 8 species that may have inhabited the System in past, historic time but apparently no longer occur there. (From auth. summ.)

9519. Murchison, A. Earl, and John J. Magnuson (U.S. Fish and Wildlife Service, Bur. Commercial Fisheries Biological Lab., Honolulu, Hawaii). 1966. NOTES ON THE COLORATION AND BEHAVIOR OF THE COMMON DOLPHIN Coryphaena hippurus. Pacific Sci., 20(4): 515-517; Biological Abstracts, 48(13): Abst. No. 67615. 1967.

Overall coloration of the common dolphin, Coryphaena hippurus Linnaeus, varied from a silver-blue to a yellowish phase with greenish intermediates. A dark vertically barred pattern occurred on the sides in conjunction with feeding. Swimming speeds of captive fish of 71.1 cm fork length was typically 56.3 cm/sec ± 1.5 cm/sec. Typical tail-beat frequencies of captive fish were the same as for fish observed at sea through underwater viewing ports of a raft (1.2 beats/sec). Swimming movements, mouth movements, body postures, chafing, and surfing were briefly described. Similarities in the behavior of C. hippurus and certain scombrids suggest that the functions may be the same and are common to many pelagic predacious fishes. (Authors)

9520. Buss, Keen. (Penn. Fish Comm., Bellefonte, Penn.). 1967. THE EVOLUTION OF FISH STOCKING IN THE UNITED STATES. Pennsylvania Angler, 36(10): 16-18.

9521. Strawn, Kirk, and James E. Dunn (Dept. Wildlife Sci., Texas Agr. and Mech. Univ., College Station, Tex.). 1967. RESISTANCE OF TEXAS SALT- AND FRESHWATER-MARSH FISHES TO HEAT DEATH AT VARIOUS SALINITIES. Tex. J. Sci., 19(1): 57-76. Illus.; Biological Abstracts, 48(14): Abst. No. 68372. 1967.

Response-surface diagrams were used to compare the resistance of 10 species of marsh fishes to heat death at various salinities. As a group the marsh cyprinodonts are the most resistant fishes known and Cyrpinodon variegatus appears to be the most resistant to heat death of the fishes tested in laboratory experiments. The habitat of a species within the salt marsh correlated with its relative resistance to heat death. Some dissolved solids in the water benefited all species during exposure of high temperature. As temperature decreased optimum salinities for survival decreased for freshwater fishes and increased for salt-marsh fishes. A sample of salt-marsh Gambusia affinis was found to be more resistant to heat death at salinities of 10 and 20 °/oo than was a sample from freshwater. (Authors)

9522. Zharov, V. L., and Yu. A. Torin. 1964. BIOLOGY AND DISTRIBUTION OF YELLOWFIN TUNA (Neothunnus albacora Lowe) IN THE TROPICAL ATLANTIC OCEAN. Tr. Atlanticheskogo Nauch-Issled Inst. Rybn. Khoz. Okeanogr., 11. 27-35. From: Ref. Zh., Biol., 1966, No. 5I116. (Translation); Biological Abstracts, 48(14): Abst. No. 68377. 1967.

In the tropical waters of the Atlantic Ocean 2 groups of yellow-fin may be recognized: small (length up to 120 cm, weight up to 30 kg), and large. Tunas of both groups form separate stocks: small, in coastal areas; large, chiefly in offshore waters. Spawning is intermittent, proceeding constantly in the equatorial region. Tuna shoals are confined to productive regions: at the southern limit of the northeast trade winds in West African waters, at the boundary between the North Equatorial current and counter-current, and at the boundary between the Bengal and South Equatorial currents. Particularly favorable conditions arise during the penetration of warm and saline waters into the productive zone.

9523. Betts, J. L., T. W. Beak, and G. G. Wilson (Fraser Cos. Ltd., Altholville, New Brunswick, Canada). 1967. A PROCEDURE FOR SMALL-SCALE LABORATORY BIOASSAYS. J. Water Pollut. Contr. Fed., 39(1): 89-96. Illus.; Biological Abstracts, 48(14): Abst. No. 69864. 1967.

A laboratory procedure for rapid testing of the toxicity of a large number of effluents to fish or the effectiveness of effluent treatment consists of a small-scale bioassay. Equipment includes an acclimatizing tank with water circulation, temperature control, and aeration, and a series of test tanks, each of about 10 gal (38 l) capacity and each containing a plexiglass fish-retention trough and equipped with a circulation pump. Test tanks are immersed in a constant-temperature bath. Small fish are used. This method requires less elaborate equipment, shorter testing periods, and easier control than full-scale continuous-flow bioassays. (Authors)

9524. Dugan, Patrick R. (Dept. Microbiol., Ohio State Univ., Columbus, Ohio). 1967. INFLUENCE OF CHRONIC EXPOSURE TO ANIONIC DETERGENTS ON TOXICITY OF PESTICIDES TO GOLDFISH. J. Water Pollut. Contr. Fed., 39(1): 63-71. Illus.; Biological Abstracts, 48(14): Abst. No. 69875. 1967.

Studies of the effects of pesticides on goldfish previously exposed to detergents revealed that goldfish exposed to alkylbenzene sulfonate (ABS) are more susceptible to the toxic effects of dieldrin and DDT than are unexposed fish. Results with sodium lauryl sulfate and linear alkylate sulfonate were inconclusive. Fish held in ABS appeared to gain weight more rapidly than control fish; the larger among the ABS-exposed fish were more resistant to subsequent exposure to pesticides. Toxicity of pollutants should be evaluated with reference to interaction with other contaminants. (Auth.)

9525. Holland, H. T., and Jack I. Lowe (U.S. Bur. Commercial Fish., Gulf Breeze, Fla.). 1966. MALATHION: CHRONIC EFFECTS ON ESTUARINE FISH. Mosquito News, 26(3): 383-385; Biological Abstracts, 48(14): Abst. No. 69879. 1967.

Spot, (Leiostomus xanthurus), were maintained in a sublethal concentration (10 ppb) of the organic phosphorus insecticide malathion for 6 months. Brain cholinesterase activity was inhibited, but the fish appeared to suffer no ill effects from the exposure. (Authors)

9526. Mathur, D. S. (Birla Coll., Pilani, Birla, India). 1965. DETERMINATION OF THE ACCUMULATION OF DDT AND BHC [BENZENEHEXACHLORIDE] IN THE LIVER AND INTESTINE OF CERTAIN FISHES. Nat. Acad. Sci. India Proc. Sect. B Biol. Sci., 34(4): 337-338; Biological Abstracts, 48(14): Abst. No. 69886. 1967.

DDT and BHC (benzenehexachloride) solutions kill the fish at various concentrations due to the absorption of these insecticides in liver and intestine. In the affected fishes, Ophicephalus punctatus, Heteropneustes fossilis, and Barbus stigma, the microquantity of absorbed DDT and BHC has been determined by labile chlorine and organic chloride methods. (Auth.)

9527. Pickering, Quentin H., and Croswell Henderson (R. A. Taft Sanit. Eng. Center, Cincinnati, Ohio). 1966. ACUTE TOXICITY OF SOME IMPORTANT PETROCHEMICALS TO FISH. J. Water Pollut. Contr. Fed., 38(9): 1419-1429; Biological Abstracts, 48(14): Abst. No. 69894. 1967.

Static bioassays conducted to determine the acute toxicity of certain petrochemicals to several species of fish in both hard and soft water showed that the mean tolerance limit (TL_m) at 96 hours for most of the chemicals fell in the range of 12-97 mg/l. Several compounds were less toxic. For most of the compounds, 96-hour TL_m was not significantly less than the 24-hour TL_m. Bluegills generally were the most sensitive species tested, followed by fatheads, goldfish, and guppies, although variation in sensitivity was small. A few of the compounds appeared slightly more toxic in soft water than in hard water. (Authors)

9528. Pickering, Quentin H., and Croswell Henderson (R. A. Taft Sanit. Eng. Center, Cincinnati, Ohio). 1966. THE ACUTE TOXICITY OF SOME PESTICIDES TO FISH. Ohio J. Sci., 66(5): 508-513; Biological Abstracts, 48(14): Abst. No. 69895. 1967.

Acute static bioassays were conducted with 13 pesticides to determine their comparative toxicity to fish. There was a wide range in the toxicity of these compounds with 96-hour TL_m (mean tolerance limit) values ranging from 0.0033 to 4.0 mg/l. Of the compounds tested, Thiodan, a chlorinated hydrocarbon, and Thimet, an organic phosphorus pesticide, were the most toxic; and Bayer 29493, an organic phosphorus compound, and Fermate, a carbamate, were the least toxic. In about half of these static tests, toxicity increased significantly with an increase of exposure time from 24 to 96 hours. The toxicity of the organic phosphorus and chlorinated hydrocarbon compounds did not appear to be influenced by the water quality characteristics (pH, hardness, alkalinity) examined. The toxicity of 2 of the carbamates was influenced by water quality characteristics. (Authors)

9529. Weiss, Charles M. (Sch. Public Health, Univ. N. C., Chapel Hill, N. C.). 1965. USE OF FISH TO DETECT ORGANIC INSECTICIDES IN WATER [REVIEW]. J. Water Pollut. Contr. Fed., 37(5): 647-658. Illus.; Biological Abstracts, 48(14): Abst. No. 71212. 1967.

9530. Larson, Omer R. (Dept. Biol., Univ. N. Dak., Grand Forks, N. Dak.). 1966. SOME HELMINTHS OF ITASCA PARK FISHES. J. Minn. Acad. Sci., 33(2): 99-101; Biological Abstracts, 48(14): Abst. No. 72145. 1967.

A helminth survey was conducted on 12 species of fish taken from the waters of Itasca State Park. An abundant and varied helminth fauna was found, with 31 parasitic forms identified to genus or species. By taxonomic groups these included, 20 trematodes, 5 cestodes, 2 acanthocephalans, and 4 nematodes. Every fish

examined was parasitized, but yellow perch and rock bass possessed the greatest variety of helminths. Based on the results of this survey, several aspects of parasite life cycles, geographic distribution, and host specificity are discussed. (Auth.)

9531. Nowlin, William J., Charles E. Price, and Edgar A. Schlueter (N. Tex. State Univ., Denton, Tex.). 1967. FIRST REPORT OF FRESHWATER MONOGENETIC TREMATODES OF TEXAS. Tex. J. Sci., 19(1): 110-111; Biological Abstracts, 48(14): Abst. No. 72199. 1967.

The freshwater Monogenea of Texas have received practically no attention from workers in this area of parasitology. Review of the literature indicates that this state has apparently not served as type locality for a single original description of a member of this group. The present authors have recently initiated a survey of the Monogenea of northern and central Texas. Preliminary findings strongly indicate that Texas possesses an abundant monogenean parasite fauna. Sixteen species of Monogenea are reported from the gills of 10 host species representing five teleost families. (Authors)

9532. Krokhin, E. M. 1963. THE PROPAGATION AND UTILIZATION OF KOKAYNEE SALMON IN JAPAN. Rybn. Khoz., 39(11): 89-91; Biological Abstracts, 48(16): Abst. No. 79070. 1967.

Kokaynee salmon (Oncorhynchus nerka kennerlyi), originating from 2 small lakes in Hokkaido, was acclimatized, since 1893, in other Japanese lakes which are characterized by: considerable depth (22 to 363 m); vertical thermal stratification with surface temperatures reaching 23° C and bottom temperatures constant at 4-5° C; favorable aeration conditions and pH; abundance of crustaceans as basic food. Most of the kokaynee are propagated naturally, and only around 20 million eggs are artificially propagated by several breeders. The brood fish are kept in small spring-water basins until fully mature. The spawn is fertilized by the dry method, spread on frames in California-type apparatus, and incubated for 1-1/2 to 2 months (e.g. from Nov. 1 to Dec. 15) at 8-9° C with a water flow of 30 liters per minute per million eggs. The eggs are disinfected twice each week for 1/2 hour with solutions of $KMnO_4$ (1:20,000) and malachite green (1:200,000-1:300,000) and are sorted out twice during the incubation period, the waste amounting to 2-5% only. The larvae are reared in ponds for 6 months, their food being supplemented with minced mysis larvae and fly maggots. Upon reaching a length of 8-10 cm they are transferred to the lake, the loss during the rearing period amounting to 10-30%. The fish grow to a size of 25-40 cm depending on locality, and are mainly used as a sport fish and partly as a valuable commercial food fish. The fishing (by angling only) is strictly regulated by laws. --Courtesy NSF (PL 83-480) 1964.

9533. Beuschold, I., and J. Jaudzims. 1965. TROUT MANAGEMENT IN LAKES FORMED BY THE BODE DAMS. Wiss. Z. Karl Marx Univ. Leipzig Math. Naturwiss. Reihe, 14(2): 275-280. Maps; Biological Abstracts, 48(15): Abst. No. 73731. 1967.

Fish management practices and productivity in 6 lakes formed by East Harz dams in the Bode river basin were investigated. Hydrological conditions and lake water analyses are given and measures designed to stock the lakes with young trout following damming are described. Productivity was investigated by analyzing the density of available larvae of Chironomideae and of the other present plankton species on which the fish feed and a table showing available food supply and yield is included. The phenomenon of diminishing fish yield with progressing age of man made lakes observed elsewhere is caused not by a decrease of the benthos biomass which actually increases but by a shift in the fish population age distribution. Measures designed to prevent such a falling yield are enumerated. The manner and density of stocking the various lakes with trout from 1961 to 1964 is

described. The high cost of yearly stocking of the lakes with young trout affecting the economy of trout raising in the lakes is discussed and recommendations designed to correct this imbalance are offered. --R. Kroha.

9534. Bulgakova, E. I. 1965. REPRODUCTIVE PATTERNS OF FISHES IN THE SVIYAGE INLET OF THE KUIBYSHEV RESERVOIR. In: Results of large-scale observations on the Sviyaga Bay fauna of the Kuibyshev Reservoir during the period of its formation. Kazan Univ: Kazan. 152-161. From: Ref. Zh., Biol., 1966, No. 7I119. (Translation); Biological Abstracts, 48(15): Abst. No. 73733. 1967.

The times of spawning were determined from the state of the sexual products of adult fish and from the frequency of occurrence of eggs and larvae at various developmental stages. The observations were carried out in the period 1960-62. The pike breeds in the Sviyaga Inlet at the end of April-beginning of May at a water temperature of 5°-7° C in quiescent shallows (depths 0.3-0.8 m) with soft meadow vegetation. The spawning area is governed by the height of the water level. A characteristic feature of the reproduction of pike in recent years has been the protraction of the spawning period to 35-40 days. Zander start spawning in the first half of May at a temperature of 9-12° C; massive spawning takes place in the second half of May. The spawning grounds are at a depth of 2-6 m. Analysis of the size composition of the zander stock showed that it consisted of a large number of age groups, and that the population abundance was fully adequate for the maintenance of a commercial stock at a high level. The bream stock was represented by a large number of age groups. The spawning season became prolonged, a circumstance which was related to the hydrological features of the water mass. In years of accelerated warming of the water the bream's spawning period is less protracted. The principal spawning grounds of bream are in the open parts of the inlet. The roach spawns in the first half of May on plants (depth, 0.3-1.2 m).

9535. Burgner, Robert L. 1962. FACTORS INFLUENCING PRODUCTION OF SOCKEYE SALMON (Oncorhynchus nerka) IN LAKES OF SOUTHWESTERN ALASKA. In: 15th Cong. of the Societas Internationalis Limnologiae, Madison, Wis., 20-25 Aug., 1962. Int. Ver. Theor. Angew. Limnol. Verh. 15(Pt. 1): 504-513. Illus. Map.; Biological Abstracts, 48(15): Abst. No. 73734. 1967.

The lake chains of southwestern Alaska are important primarily as spawning and nursery areas for anadromous sockeye salmon. Salmon population level per unit area of lake varies greatly among the producing lake chains. However, among the lakes of the Wood River chain, average population level is currently proportional to lake area. Limnological conditions for growth of young salmon are shown to be quite uniform among the Wood River Lakes, but growth is retarded when population density increases. It is suggested that the level of sockeye salmon populations in individual lakes is limited primarily by the rearing capacity of the lake nursery areas. (Auth.)

9536. Smirnov, A. I., and M. S. Kamyshnaya (Dept. Cytol., Moscow State Univ., Moscow, USSR). 1965. BIOLOGY OF IMMATURE PINK SALMON (Oncorhynchus gorbuscha) IN RELATION TO ITS REARING AND ACCLIMATIZATION. Zool. Zh., 44(12): 1813-1824. Illus. (Engl. summ.); Biological Abstracts, 48(15):Abst. No. 73761. 1967

A comparative-morphometric study of the young pink salmon—Oncorhynchus gorbuscha (Walb.)—was carried out on fish from rivers of the natural range (Sakhalin Island) and from those of the acclimatization region (the Kola Peninsula). In the latter case the fish stayed in the river for a long time. Features in the structure and behavior of larvae and advanced fry are described; the composition of food of the migratory young is presented. It is peculiar of pink salmon to migrate downstream in the form of larvae at the stage of mixed feeding. This genetically stable species peculiarity of the pink salmon biology remains in the new specific conditions. A certain delay in the migration of the fish from Murmansk rivers, occurring at the same developmental stage, is associated with an intensive day-long illumination (polar day). It is concluded that a prolonged artificial delay of pink salmon in the river is undesirable. Conditions promoting catadrome migration and survival of the fish are characterized. (Authors)

9537. Sorokin, J. I., and D. A. Panov (Inst. Biol. Inland Waters, Borok, Nekouz, Jaroslavl, USSR). 1966. THE USE OF C^{14} FOR THE QUANTITATIVE STUDY OF THE NUTRITION OF FISH LARVAE. Int. Rev. Gesamten Hydrobiol., 51(5): 743-756; Biological Abstracts, 48(15): Abst. No. 73764. 1967.

The radiocarbon method of estimating the elements of the nutrition balance equation is described. With the use of this method the ration, the assimilation, the assimilability, the "active" respiration, the coefficients of use of consumed and of assimilated food for growth were measured for bream larvae at different stages of their development and at different concentrations of "food" zooplankters (Bosminae). The optimum concentration of the "food" organisms for the nutrition of the bream larvae ranged between 600-800 Bosmina longirostris per l (corresponding wet biomass 1-2 g/m^3). A low limit of concentration of food for the larvae was determined by comparison of the values for assimilation and the loss during respiration at different concentrations of Bosminae. It was found to be about 45-60 Bosminae per l (corresponding biomass 0.1 to 0.15 g/m^3). (Authors)

9538. Toetz, Dale W. (Dept. Zool., Okla. State Univ., Stillwater, Okla.). 1966. THE CHANGE FROM ENDOGENOUS TO EXOGENOUS SOURCES OF ENERGY IN BLUEGILL SUNFISH LARVAE. Invest. Indiana Lakes Streams 7. 115-146. Illus.; Biological Abstracts, 48(15): Abst. No. 73766. 1967.

The numerical strength of a year class of fish is probably established before metamorphosis from larvae to adult. Factors investigated that affect the survival of bluegill sunfish larvae, Lepomis macrochirus, are the characteristics of the ova, fertility, hatching, and the events marking the "critical period" when the larvae switch from endogenous to exogenous nutrition. Mature unfertilized bluegill ova are pale yellow, average about 1 mm in diameter, and stick readily to a substrate after stripping. Atretic ova were observed upon stripping eggs from females held in the laboratory and from a few fish trapped in lakes. These ova exhibit erosion of the yolk, have a low viability, and do not adhere well to a substrate. The fertility and hatchability of mature bluegill ova varied from 80 to 90% in the laboratory. Ova nearest the urogenital vent had a higher hatching percentage than more anterior ova. No significant mortality of eggs or larvae was caused by visible light from fluorescent bulbs. At 23.5° C in constant light, the mean hatching time was about 45 hours after fertilization. However, constant light lengthened the hatching interval by 3 hours. In order to define the critical period, observations were made daily on the morphology and behavior of larvae from artificially fertilized eggs, and the larvae were sampled daily to follow their protein and energy metabolism. The onset of feeding and a decline in the dry weight, protein content, and energy content of the bluegill embryo marked the beginning of the critical period, 6.4 days after fertilization (4.4 days after hatching). Between 8.5 and 9 days, starvation was manifested by a diminution of feeding success and food-seeking movements, a cessation of gain in total length, and the time of 50% mortality. These characteristics were used to define the end of the critical period. The above criteria and others, such as the disappearance of the yolk sac and the diminution of total protein and total energy, are discussed in an effort to establish criteria that could be used to define the critical period for larval fishes in general. No one characteristic, single or in combination with others, was found to be valid for the demarcation of the critical period in all species. (Auth.)

9539. Zubina, N. F. (Kaliningrad Tech. Inst. Fish Ind., Kalingrad, USSR). 1966. CHARACTERISTICS OF RAINBOW TROUT (Salmo gairdneri) BLOOD IN CONNECTION WITH FATTY DEGENERATION OF THE LIVER. Izv. Vyssh. Vcheb. Zaved. Pishch. Teknol., 3. 69-71; Biological Abstracts, 48(15): Abst. No. 74396. 1967.

In comparison with healthy specimens, the concentration and amount of hemoglobin per unit of body weight is reduced in fish suffering from fatty degeneration of the liver; this is mainly due to a decrease in the concentration and amount of hemoglobin in the erythrocytes, and to a lesser degree to a drop in the number of erythrocytes per mm^3 of blood. When the rainbow trout changes over to its natural food the total hemoglobin content in its body increases. (Auth. summ. transl.)

9540. Puchkov, N. V. 1958. ROLE OF LEUKOCYTES IN DIGESTION AND OVULATION OF FISH. Tr. Soveshch. Ikhtiol. Komis. Akad. Nauk SSSR. 8. 186-196; Ref. Zh., Biol., 1960, No. 35215. (Translation); Biological Abstracts, 48(15): Abst. No. 74773. 1967.

Leukocytes, moving from the intestinal wall, were found in the intestinal mucus of carp. Lymphocytes prevailed, monocytes and cells similar to neutrophils were also found. The enzymes of leukocytes from blood of fish were studied and active amylase and protease were found, as well as enterokinase, a ferment activating pancreatic trypsinogen. Leukocytes play an important role in conveying fats from the intestine. Characteristic shifts in the leukocytic composition of blood of various fish species during the spawning period indicate the importance of the role of leukocytes in ovulation. Active proteolytic enzymes, amylase and lipase, were found among the enzymes of ovarian fluids. --Courtesy NSF (PL 83-480) 1963.

9541. Hassler, Thomas J., John M. Neuhold, and William F. Sigler (Dept. of Wildlife Resources, Utah State Univ., Logan, Utah). 1967. EFFECTS OF ALKYL BENZENE SULFONATE ON RAINBOW TROUT. Bureau of Sport Fisheries and Wildlife Technical Paper 16. 15 p.

Toxicity of detergent levels to rainbow trout was determined by probit analysis. Effects on gill tissues and blood were noted and measured. The LC_{50} was 3.48 mg/l ABS after 24 hours exposure and 2.53 mg/l after 120 hours. Initial increase in respiratory rate was followed by loss of equilibrium, violent and erratic swimming, lethargy, and death. Microhematocrit values, circulating red blood cells, total plasma proteins, leukocytes, and the number of mucus cells on the gill filament tips increased as ABS concentration increased and decreased with time. Destruction of gill tissues was severe. The respiratory surface was greatly reduced by lysis and clumping of the lamellae. Edema in the epithelial cells of the lamellae and thrombi in the capillaries were evident. (Authors)

9542. Bullis, Harvey R., Jr., and John R. Thompson (Bur. of Commercial Fisheries Exploratory Fishing Base, Pascagoula, Miss.). 1967. PROGRESS IN EXPLORATORY FISHING AND GEAR RESEARCH IN REGION 2, FISCAL YEAR 1966. U.S. Fish and Wildlife Service, Bur. of Commercial Fisheries, Circular 265. 14 p.

Activities of the past year included explorations by the R/V Oregon in the South Atlantic Ocean and Caribbean Sea, collection of data on shrimp behavior, and work on other research projects. (Authors)

9543. Peters, John C. (Montana Fish & Game Dept., Helena, Mont.). 1967. EFFECTS ON A TROUT STREAM OF SEDIMENT FROM AGRICULTURAL PRACTICES. Jour. of Wildlife Management, 31(4): 805-812.

The effects of sedimentation rates, stream discharge and water temperature were studied in Bluewater Creek, Montana. Trout of all ages were abundant where sediment concentrations or loads were low (range in daily load 0.2-11 tons) and stream discharge stable (range in mean daily discharge 10.0-12.0 cfs). Few trout were found where sediment concentrations or loads were high (range in daily load 2-1,800 tons) and discharge erratic (range in mean daily discharge 4-485 cfs). Water temperatures were higher than desirable for trout (above 80° F for more than 3 hours on summer days) in areas of the stream influenced by irrigation surface return flow. The best survival of trout eggs (97 percent survival) was found where stream discharge was stable and sediment concentrations were low. (Auth.)

9544. Becker, C. Dale, and Wayne D. Brunson (Fisheries Research Inst., Univ. of Washington, Seattle, Wash.). 1967. Diphyllobothrium (CESTODA) INFECTIONS IN SALMONIDS FROM THREE WASHINGTON LAKES. Jour. of Wildlife Management, 31(4): 813-824.

The dynamics of infection by larval Diphyllobothrium (Cestoda) in populations of salmonid fishes from three western Washington lakes (Goodwin, Shoecraft, and

Silver) were studied from June 1963 to June 1966. Plerocercoids were acquired by the fish primarily during the summer when subsurface water temperatures (0-20 ft) were at an annual maximum. Intensities of infection were generally higher in rainbow trout (Salmo gairdneri) from Goodwin Lake than in rainbows from Shoecraft and Silver lakes in each season. Comparison of infections in rainbows with that in other species of salmonids in Goodwin Lake revealed distinctly lower intensities in lacustrine coho salmon (Oncorhynchus kisutch), but only slightly lower intensities (one season of observations) in cutthroat (Salmo clarki), and brook trout (Salvelinus fontinalis). These differences were probably relative to feeding rates of each species on zooplankton. Chronic mortalities occurred in association with warm temperatures during the initial spring, summer, and fall after the fish were planted, when plerocercoid development was comparatively rapid and the fish were relatively small. An epizootic, however, occurred in Goodwin Lake in the winter of 1963-64, when infections reached an average of 78 plerocercoids per fish in spring-plant rainbows, 140 in fall-plant rainbows, and 38 in spring-plant cohos. The factors responsible for this outbreak remain unknown. Considerations for the control of infections in salmonids based on the parasite's life cycle and host relationships are discussed. (Authors)

9545. Rosenblatt, Richard H., and George S. Losey, Jr. (Scripps Inst. of Oceanography, Univ. of Calif. at San Diego, La Jolla, Calif.). 1967. ALARM REACTION OF THE TOP SMELT, Atherinops affinis: REEXAMINATION. Science, 158(3801): 671-672.

We did not observe the reported alarm reaction of the top smelt Atherinops affinis (Ayres) when presented with a methanol extract of whole top smelt; we interpret the reaction as an experimental artifact. Rather, a methanol extract of top smelt is an attractant, as is methanol extract of shrimp. (Authors)

9546. Todd, John H., Jelle Atema, and John E. Bardach (School of Natural Resources, Univ. of Michigan, Ann Arbor, Mich.). 1967. CHEMICAL COMMUNICATION IN SOCIAL BEHAVIOR OF A FISH, THE YELLOW BULLHEAD (Ictalurus natalis). Science, 158(3801): 672-673.

Studies of behavior in yellow bullheads showed that they recognized individuals of their own species by means of pheromones. After training by reward and punishment, blinded bullheads were able to discriminate between the odors of two donor fish, but they lost this ability when deprived of their sense of smell. The main source of the intraspecific chemical stimuli involved in recognition is the mucus. A change in status after fighting was chemically communicated to other bullheads. (Authors)

9547. Van Meter, Harry D., and William F. Shepherd (Bur. of Commercial Fisheries, Sandusky, Ohio). 1967. FISHERY PICTURE CHANGING IN LAKE ERIE. The Conservationist, New York State Conservation Dept., 22(2): 2-3.

In the summers of 1966 and 1967 the Bureau of Commercial Fisheries conducted fishery-limnological studies of Lake Erie. Information obtained benefits both sport and commercial fishermen. Several thousand fish of 23 species were taken in the study. In spite of increased evidences of pollution, the biologists were encouraged by the results of the two surveys, particularly in the continuing productivity of desirable fishes.

9548. Ajmal, M., and Betty C. Hobbs (Food Hygiene Lab., Central Public Health Lab., London, England). 1967. CAUSES AND EFFECTS OF COLUMNARIS-TYPE DISEASES IN FISH. Nature, 215(5097): 141-142.

Diseases affecting salmon, sea-trout and coarse fish and characterized by the occurrence of skin lesions have been recognized for some time in the rivers of England, Scotland, and Ireland. During 1966 there were epidemics in parts of Ireland as well as Cumberland, Lancashire and southern counties of England. The British and Irish governments intervened to control the movement of live fish and eggs from infected areas, and a programme of research was begun to identify the causative organisms and the nature of the diseases. Three communications describe some of the results obtained in government-sponsored and independent research.

9549. Anonymous. 1967. RETURN OF THE SALMON. Newsweek, 70(13): 101-102.

Development of a better food for hatchery-reared coho salmon has doubled the length of smolts released to the sea. The "Oregon pellet" is a BB-size solid containing pasteurized fish viscera, meal, corn oil and thirteen types of vitamins. Both commercial and sport harvests of coho along the Oregon and Washington coast have increased since the release of larger hatchery fish.

9550. Walburg, Charles H., and Paul R. Nichols (Bur. of Commercial Fisheries Biological Lab., Beaufort, N. C.). 1967. BIOLOGY AND MANAGEMENT OF THE AMERICAN SHAD AND STATUS OF THE FISHERIES, ATLANTIC COAST OF THE UNITED STATES, 1960. U. S. Fish and Wildlife Service, Special Scientific Report --Fisheries No. 550. 105 p.

This paper summarizes current information on the American shad, Alosa sapidissima, and describes the species and its fishery. Emphasis is placed on (1) life history of the fish, (2) condition of the fishery by State and water area in 1960 compared to 1896 when the last comprehensive description was made, (3) factors responsible for decline in abundance, and (4) management measures. The shad fishery has changed little over the past three-quarters of a century, except in magnitude of yield. Types of shad-fishing gear have remained relatively unchanged, but many improvements have been made in fishing techniques, mostly to achieve economy. In 1896 the estimated catch was more than 50 million pounds. New Jersey ranked first in production with about 14 million pounds, and Virginia second with 11 million pounds. In 1960 the estimated catch was slightly more than 8 million pounds. Maryland ranked first in production with slightly more than 1.5 million pounds, Virginia second with slightly less than 1.4 million pounds, and North Carolina third with about 1.3 million pounds. Biological and economic factors blamed for the decline in shad abundance, such as physical changes in the environment, construction of dams, pollution, overfishing, and natural cycles of abundance, are discussed. Also discussed are methods used for the rehabilitation and management of the fishery, such as artificial propagation, installation of fish-passage facilities at impoundments, and fishing regulations. With our present knowledge, we can manage individual shad populations; but, we probably cannot restore the shad to its former peak of abundance. (Authors)

AUTHOR INDEX FOR VOLUME 12

Adams, J.R., 9108, 9489
Ajmal, M., 9548
Alabaster, J.S., 9437
Alexander, Gaylord R., 9389
Alexander, R. McN., 9221, 9243
Allen, George H., 9367
Allison, Leonard N., 9066
Allison, Ray, 9320, 9345
Alperin, Irwin M., 9254, 9255
Alverson, Dayton L., 9472
Anderson, Gote, 9410
Anderson, J.B., 9065
Anderson, Lauren D., 9133
Anderson, P.D., 9252
Anderson, William D., 9151
Anonymous, 9068, 9080, 9238, 9257, 9274, 9385, 9416, 9549
Arthur, C.R., 9051
Ashby, Kenneth Roy, 9426
Ashley, Laurence M., 9209
Atema, Jelle, 9546
Atherton, Maxine, 9260
Au, David W.K., 9411

Baird, Ronald C., 9228
Baker, Alan N., 9177
Bakshtansky, E.L., 9422
Ball, Robert C., 9050
Balon, Eugen K., 9473
Bams, R.A., 9299
Bardach, J.E., 9234, 9512, 9546
Barkley, Harry, 9358
Barkuloo, James M., 9328
Bartlett, Martin R., 9149
Battle, H.I., 9252
Bay, Ernest C., 9179
Bayliff, William H., 9119
Beak, T.W., 9523
Bearden, Charles M., 9371
Beardsley, Grant L., Jr., 9316
Beasley, P.G., 9323, 9353
Becker, Clarence D., 9108, 9544
Behmer, David J., 9507
Bennett, George W., 9132, 9318
Berger, Bernard L., 9062
Berlin, J.D., 9166
Berst, A.H., 9197
Besse, P., 9474, 9445
Betts, J.L., 9523
Beuschold, I., 9533
Beyerle, George B., 9374
Bidgood, B.F., 9197
Birdsong, Ray S., 9183
Black, Edgar C., 9292
Blackburn, R.D., 9323, 9330
Blumer, Max, 9079
Boehlke, K.W., 9516
Bowes, Anne LaBastille, 9097
Bowling, Michael L., 9342
Boyar, H.C., 9401
Boyle, H.W., 9403
Brady, Lee E., 9336
Brewer, Jack, 9460
Bross, Michael G., 9049
Brown, Bradford E., 9365
Brunson, Wayne D., 9544
Brown, C.J.D., 9139
Brynildson, Clifford L., 9400
Brynildson, Oscar M., 9396, 9400
Buescher, C.A., Jr., 9044
Bulgakova, E.I., 9534
Bulkley, Ross V., 9290
Bullis, Harvey R., Jr., 9086, 9542
Bunting, Dewey L., 9361
Burck, Wayne A., 9057
Burdick, G.E., 9277
Burgner, Robert L., 9535
Burress, Ralph M., 9168
Burrows, Roger E., 9040
Burttschell, R.H., 9403
Busbee, Raymond L., 9144, 9362
Buss, Keen, 9300, 9520
Byrd, W. Keith, 9328

Caillouet, Charles W., Jr., 9259
Cairns, John, Jr., 9233
Camey, T., 9431
Campbell, H.J., 9394
Cantwell, Robert, 9218
Carlson, Dale R., 9502
Carmichael, J.W., 9287
Carter, Bernard T., 9273
Carter, Luther J., 9226
Carter, Wilfred M., 9261
Casagrande, Dirk, 9275
Chadwick, Harold K., 9397
Chapman, D.W., 9394
Chapman, Heather M., 9455
Chappel, C., 9396
Charles, James R., 9269, 9305
Charnell, Robert L., 9412
Chase, Joseph, 9076
Chiappetta, Jerry, 9237
Childers, William F., 9132, 9318
Clark, Francis W., 9124
Clarke, Norman A., 9497
Cleaver, F.C., 9384
Clifford, R.A., 9401
Coates, J.A., 9202
Coble, Daniel W., 9114
Coburn, A., 9113
Colby, Peter J., 9391
Colgrove, D.J., 9245
Collette, Bruce B., 9072, 9180
Colman, J.R., 9100
Conder, John R., 9334

Cooper, Gerald P., 9265
Cooper, Richard A., 9088
Copeland, B.J., 9496, 9503
Copeland, J.B., 9322
Cordone, Almo J., 9369
Corey, Bob, 9412
Cory, Robert L., 9210
Cowan, C. Michael, 9170
Cowell, Bruce C., 9052
Craven, Richard E., 9452
Crickmer, R., 9234
Crittenden, Edward, 9324, 9355
Crosby, D.G., 9235
Cuerrier, Jean-Paul, 9167
Cumming, Kenneth B., 9378
Cunningham, E.B., 9470
Cutting, Richard E., 9156

Dahlberg, Michael L., 9091, 9117
Danyulite, G.P., 9466
Davis, James T., 9332, 9359
Davis, William Spencer, 9289
Dean, John Mark, 9166
Dechtiar, Alex, 9251
Dedukhova, V.A., 9429
Degurse, Paul E., 9395
de Kinkelin, P., 9445, 9474
Demel, K., 9438
Dexter, Ralph W., 9060
Dieffenbach, William H., 9171
Dill, Lawrence M., 9083
Ditsworth, George R., 9405
Dollar, Alexander M., 9199, 9200
Donaldson, Lauren R., 9476
Doudoroff, Peter, 9123, 9278
Dougherty, J.H., 9044
Dovel, William, 9313
Downing, A.L., 9437
Doxtater, Gary, 9059
Doyle, J., 9125
Dragovich, Alexander, 9150
Dugan, Patrick R., 9524
Dunn, James E., 9093, 9521
Dupree, Harry K., 9039, 9041, 9386
Durkin, Joseph T., 9138

Eales, J.G., 9293
Edelhauser, Henry F., 9468
Edmund, Norman W., 9126
Edmundson, Eldon H., 9381
Edwards, H.E., 9189
Eleftheriou, B.E., 9516
Elliot, Joseph W., 9040
Elliott, J.M., 9420
Ellison, Robert L., 9029
Elson, P.F., 9190
Evans, E. Edward, 9386
Everest, Fred H., 9381
Everhart, W. Harry, 9156
Evropeitseva, N.V., 9439

Faber, Daniel J., 9291
Fadeev, E.V., 9429
Falk, Hans L., 9214
Fel'dman, M.B., 9450
Ferguson, Denzel E., 9317, 9506
Fields, Paul E., 9513
Fishelson, L., 9070
Flux, E.G., 9116
Follett, W.I., 9298
Forney, John L., 9157
Fortune, J.D., 9394
Fowler, Laurie G., 9038, 9040
Frank, Stanislav, 9440
Frantz, Ted C., 9369
Freeman, Barry, 9358
Frey, John E., 9364
Friend, A.G., 9501
Fromm, Paul O., 9468, 9500
Frost, Herbert H., 9456
Fry, Donald H., Jr., 9370
Fry, F.E.J., 9264
Fry, James P., 9340
Frye, John, 9223
Suchs, Everett H., 9388
Fujihara, M.P., 9380
Fukuda, Y., 9384
Fuller, Jefferson C., 9319, 9329
Funderburk, H.H., Jr., 9323

Gakstatter, Jack H., 9393
Galkina, L.A., 9441
Galkina, Z.I., 9442
Gardner, Daniel T., 9506
Gasaway, Charles R., 9049
Gauley, Joseph R., 9071
Geiger, S.E., 9118
Geldreich, Edwin E., 9497
Gerald, Jerry W., 9173, 9228
Gerking, Shelby D., 9106
Gibbs, Robert H., Jr., 9072
Gibson, R.J., 9109
Gideiri, Yousif Babiker Abu, 9240
Gilbreath, William J., 9336
Gilderhus, Philip A., 9053, 9062
Giudice, John J., 9348
Gladkova, M.G., 9443
Godfrey, H., 9384
Goldblatt, Leo A., 9213
Gomenyuk, E.S., 9514
Gooch, B.C., 9351
Goodyear, C. Phillip, 9317, 9392
Gordon, Malcolm S., 9263
Gould, William R., 9174, 9333
Grabda, Eugeniusz, 9479
Grant, C.D., 9193
Greenhood, Edward C., 9184
Grenfell, Ralph A., 9267
Greselin, E., 9396
Grimås, Ulf, 9436
Groot, C., 9471

Guibert, Francois, 9483
Guillon, J. C., 9445

Haertel, Lois, 9416
Halver, John E., 9208
Hamer, Paul E., 9028
Hanamura, N., 9281
Hanks, James J., 9219
Hansen, Donald F., 9224
Hanson, Jack A., 9366
Hanson, Ronald L., 9418
Hanson, Willis D., 9339
Harvey, Harold H., 9095
Hassler, Thomas J., 9541
Hassler, William W., 9027
Hastings, W. H., 9350
Hatcher, Robert M., 9326
Heard, William R., 9382
Heimer, John T., 9377
Helms, Don R., 9134
Hemmings, C. C., 9231, 9232
Henderson, Croswell, 9527, 9528
Henderson, Harmon, 9347
Henley, James P., 9270
Herr, F., 9396
Hess, Paul W., 9087
Heyland, Joan, 9261
Hickman, Cleveland P., Jr., 9427
Hirano, Yoshimi, 9309
Hobbs, Betty C., 9548
Hobson, Edmund S., 9428, 9459
Hoese, Doug, 9128
Hoese, H. Dickson, 9128
Hoffarth, Ray, 9334
Hoffert, J. Russell, 9468
Hoffman, G. L., 9491
Holland, H. T., 9525
Horak, Donald L., 9099
Hoss, Donald E., 9090
Houser, Alfred, 9093
Hovey, Larry, 9414
Howard, John K., 9249
Hubbell, Grace G., 9266
Hubbs, Clark, 9228
Hudson, J. C., 9325
Hughes, G. M., 9248
Hughes, Janice S., 9332, 9359
Huish, Melvin T., 9322
Hulsey, Andrew H., 9335
Hunn, J. B., 9500
Hunt, Robert L., 9056

Ide, F. P., 9191
Ingram, William Marcus, 9215
Irwin, W. H., 9333, 9361, 9402
Isaacson, Peter A., 9127
Ishida, T., 9282

Jackson, E. W., 9201
Jacobsen, Theodore V., 9158
Jacoby, Gertrude H., 9427
Jahn, L. A., 9139
Jaudzims, J., 9533
Jensen, Albert C., 9378
Jensen, Paul T., 9185
Johnson, C. L., 9495
Johnson, C. M., 9247
Johnson, M. G., 9131
Johnson, Welburne Dewitt, 9042
Johnson, William C., 9383
Johnston, C. E., 9293
Jones, J. W., 9242
Jones, R. O., 9344
Juhl, Rolf, 9086
Julin, Arnold M., 9033, 9037
Junge, Charles O., 9462

Kamyshnaya, M. S., 9536
Katko, Albert, 9510
Katz, Harvey M., 9089
Katz, Max, 9108
Kawashima, Rihei, 9457
Keast, Allen, 9104
Keenleyside, Miles H. A., 9124, 9192
Kelly, H. D., 9320
Kelly, John A., Jr., 9150
Kelly, William H., 9092
Kennedy, V. S., 9279, 9414
Kerswill, C. J., 9188, 9189
King, Darrell L., 9050
King, George R., 9120
King, Willis, 9327
Kirkland, Leon, 9356
Kirpichnikov, V. S., 9499
Klein, William D., 9099, 9373
Klontz, George W., 9444
Kondo, Heihachi, 9309
Krishnamoorthi, K. P., 9434
Krokhin, E. M., 9532
Kube, Harold D., 9219
Kulikowski, J., 9438
Kuroki, Toshiro, 9457
Kwiatkowska-Grabacka, Elzbieta, 9435
Kyushin, Ken-Ichiro, 9457

Lacroix, Yves, 9275
Lahav, M., 9069
Lahser, Carl W., Jr., 9135
Lambou, Victor W., 9049, 9357
Landrum, B. J., 9164
Langford, R. R., 9169
La Roche, Gilles, 9495
Larson, Omer R., 9530
Lawrence, J. M., 9323
Leahy, John S., 9145
Lebedev, N. V., 9429
Lee, G. Fred, 9042, 9045
Legler, Donald W., 9386
Leim, A. H., 9026
Lennon, Robert E., 9062

Leong, Roderick, 9288
Lesser, Charles A., 9268
Levaditi, J. C., 9445
Lewis, William M., 9129, 9130
Libosvarsky, Jiri, 9462
Lindley, Ancil L., 9506
Lindstrom, Thorolf, 9446
Lockard, Dale V., 9376
Loeb, Howard A., 9163
Logan, Herschell J., 9354
Logvinenko, B. M., 9429
Lohnisky, Karel, 9481
Lopinot, A. C., 9315
Losey, George S., 9545
Louder, Darrell E., 9321
Lowe, Jack I., 9525

MacInnis, Joseph B., 9077
Mackenthun, Kenneth M., 9215
Mackett, David J., 9184
Magnuson, John J., 9519
Major, Richard L., 9073
Manion, Patrick J., 9063, 9102
Mansell, W. D., 9222
Marchioni, Warren W., 9089
Margolis, L., 9198, 9384
Marking, Leif L., 9032, 9037
Marr, D. H. A., 9153
Marshall, Harold G., 9311
Martin, N. V., 9294
Martin, R. O. R., 9418
Marvin, Kenneth T., 9074
Mason, John W., 9056, 9395
Mason, William T., Jr., 9065
Mathis, William P., 9336, 9375
Mathur, D. S., 9526
Mawdesley-Thomas, Lionel E., 9145
May, Otho D., Jr., 9329, 9354
McBride, J. R., 9112, 9118
McCarraher, D. Bruce, 9060
McCart, P., 9113, 9121
McClain, Alberton L., 9063
McClane, A. J., 9258
McCleave, J. D., 9139
McCombie, A. M., 9115
McCormick, J. Howard, Jr., 9038
McCoy, Edward G., 9321
McCrimmon, Hugh R., 9111
McLaren, Ian A., 9295, 9296
Mel'nikova, M. N., 9515
Meltzoff, Stanley, 9461
Metcalf, Artie L., 9518
Merrell, John C., Jr., 9510
Meyer, Fred P., 9262
Mighell, James L., 9073
Mihursky, J. A., 9279, 9414
Mikhailova, I. G., 9478
Miller, Denny M., 9091
Miller, Donovan, 9308
Miller, Jack, 9300
Miller, Lee W., 9064
Miller, Robert Rush, 9176
Miller, Robert Victor, 9312, 9387
Ming, Arvil, 9049
Mink, Ken, 9078
Mironova, N. F., 9475
Mironova, N. V., 9463
Mitchell, Charles T., 9368
Miyake, Makoto, 9309
Moe, Martin A., Jr., 9103
Mokryak, T. S., 9493
Momot, Walter T., 9096
Morita, Yukitomo, 9477
Morris, A. George, 9055
Morrison, George E., 9065
Morrison, William J., 9165
Mount, Donald I., 9094, 9276
Mulla, Mir S., 9133
Muncy, Robert J., 9352
Munro, J. L., 9244
Murchison, A. Earl, 9519
Murphy, Joseph R., 9456
Myers, George S., 9175

Nagata, Thomas H., 9142
Nail, Merril L., 9331
Nakatani, Roy E., 9196, 9380
Nakatsukasa, Yasuo, 9430
Nakayama, Nobuyki, 9309
Naylor, H. B., 9455
Neave, Ferris, 9285, 9286
Needham, P. R., 9247
Nefedov, G. N., 9429
Nelson, Walter R., 9148
Neuhold, John M., 9541
Newberne, Paul M., 9211
Nichols, Maynard M., 9029
Nichols, Paul R., 9312, 9550
Nikiforov, N. D., 9423
Nilsson, Nils-Arvid, 9409, 9436
Norlin, Ake, 9407
Novelli, G. D., 9207
Nowlin, William J., 9531
Nyman, Lennart, 9406

O'Brien, Patrick, 9367
Ogawa, Yoshinori, 9447
Olla, Bori L., 9089
Osterberg, Charles, 9416
Ostroumova, I. N., 9425
Ovchinnikov, V. V., 9482
Owen, R. W., Jr., 9147

Panov, D. A., 9537
Parisot, Thomas J., 9372
Park, Donn L., 9138
Patterson, R. S., 9498
Pauley, Gilbert B., 9194, 9196
Paulik, G. J., 9119
Paulini, E., 9431

Penaz, Milan, 9464
Perkins, Herbert C., 9220
Perrin, William F., 9064
Perry, Wesley Guthrie, Jr., 9141
Peters, John C., 9543
Pfeiffer, Peter W., 9271, 9272, 9225, 9301, 9302, 9303, 9304
Pfitzner, Ingrid, 9509
Pflieger, William L., 9152
Phelps, Richard A., 9212
Phinney, Duane E., 9091, 9117
Pickering, Quentin H., 9527, 9528
Pierce, Phillip C., 9364
Pillai, S. C., 9081
Pinkas, Leo, 9186
Platzer, Edward G., 9489
Poole, John C., 9160, 9161, 9162
Porcella, D. B., 9501
Post, George, 9107
Potts, T. J., 9202
Power, G., 9100, 9230
Powers, Charles F., 9236
Powers, James E., 9097
Prazdnikov, E. V., 9478
Premvati, G., 9419
Price, Charles E., 9531
Priegel, Gordon R., 9061, 9098
Prits, K. I., 9466
Proctor, Raphael R., Jr., 9074
Protasov, V. R., 9458
Puchkov, N. V., 9540
Pycha, Richard L., 9120

Rabanal, H. R., 9351
Rabe, Fred W., 9137, 9216
Rahrer, Jerold F., 9390
Raney, Edward C., 9227
Reed, Roger J., 9101
Richards, C. E., 9398
Richards, William J., 9178
Ricker, W. E., 9284
Ridgway, George J., 9195
Rigler, F. H., 9051, 9169
Robeck, Gordon G., 9402
Roberts, Franklin L., 9054
Robertson, Andrew, 9236
Robinson, Jordan A., 9262
Rogers, Wilmer A., 9046, 9047, 9346, 9363
Rosen, A. A., 9403
Rosenblatt, Richard H., 9545
Ross, A. John, 9444
Rothschild, Brian J., 9159
Rounsefell, George A., 9148
Rucker, Robert R., 9203
Ruggles, C. P., 9031

Sale, Peter F., 9253
Salmon, Michael, 9181
Sandercock, F. K., 9294
Sano, S., 9283
Sarig, S., 9069
Sathyanesan, A. G., 9487
Sato, Osamu, 9457
Saunders, Richard L., 9110
Scarpelli, Dante G., 9206
Schlueter, Edgar A., 9531
Schluter, Marlis, 9432
Schoettger, Richard A., 9033, 9034, 9035, 9036, 9037, 9058
Schumann, George O., 9220
Scott, W. B., 9026, 9154, 9256
Sears, Mary, 9075
Seckel, Genter R., 9412
Seibert, Henri C., 9155
Seymour, Allyn H., 9476
Shabalina, A. A., 9448
Shamardina, I. P., 9449
Shannon, James E., 9045
Shannon, Walter S., 9250
Shepherd, William F., 9547
Shetter, David S., 9389
Shilo, M., 9069
Shpet, G. I., 9450
Shumway, Dean L., 9123, 9278
Sigler, William F., 9541
Simon, Raymond C., 9199, 9200
Sinha, V. R. P., 9242
Sinnhuber, R. O., 9204
Sisk, Morgan E., 9469
Skrinde, R. T., 9044
Slack, H. D., 9297
Slatick, Emil, 9289
Smirnov, A. I., 9536
Smith, Gerald Ray, 9187
Smith, Howard D., 9476
Smith, Lloyd L., Jr., 9391
Smith, M. W., 9084, 9085
Smith, Ruth A., 9087
Smuckler, Edward A., 9199, 9200
Sneed, Kermit E., 9041
Snow, J. R., 9325, 9349
Sokolova, M. M., 9465
Solewski, Wlodzimierz, 9451
Sorokin, J. I., 9537
Sova, Carl R., 9405
Sparrow, R. A. H., 9105
Spencer, Sam L., 9379
Springer, Stewart, 9490
Spyridakis, Demetrios, 9042
Srinath, E. G., 9081
Srivastava, L. P., 9241
St. Amant, James, 9133
Stephan, Charles E., 9094
Stephens, Robert R., 9469
Steucke, Erwin W., Jr., 9058
Stevens, Robert E., 9319, 9354
Stewart, Nelson E., 9123
Stewart, R. Keith, 9215
Stout, Wendell H., 9267

Strawn, Kirk, 9521
Strel'tsova, S. V., 9425
Stringer, G. E., 9082, 9122
Stroud, Richard H., 9280
Sultamuratov, M., 9504
Summerfelt, Robert C., 9129, 9130
Surber, Eugene W., 9343
Suttkus, Royal D., 9146
Swallow, Mary, 9075
Swanson, George A., 9217
Swartzell, Phillip G., 9185
Swee, U. Boon, 9111
Swingle, H. S., 9351
Symons, James M., 9403

Taba, Stanley S., 9456
Takemura, Yoshio, 9447
Tarkovskaya, O. I., 9494
Tatum, Walter M., 9330
Thatcher, Thomas O., 9043
Thomas, Allan E., 9038
Thomas, M. L. H., 9229
Thomaston, Willard W., 9337
Thompson, Clark S., 9289
Thompson, J. Douglas, 9508
Thompson, John R., 9542
Thompson, Robert N., 9377
Thorson, Thomas B., 9170
Tiainen, O. A., 9480
Tibbo, S. N., 9154, 9256
Tiemeier, O. W., 9516
Todd, I. S., 9030
Todd, J. H., 9234, 9546
Tody, Wayne H., 9067
Toetz, Dale W., 9538
Tomlinson, N., 9118
Topp, Robert W., 9424
Torin, Yu. A., 9522
Tredwell, S. J., 9292
Trent, Lee, 9027, 9314
Tucker, R. K., 9235
Tugarina, P. Ya., 9514
Turdakov, A. F., 9486
Tzimoulis, Paul, 9433

Ueyanagi, Shoji, 9249
Ulrich, M. Gene, 9129, 9130
U. S. Bureau of Commercial Fisheries, 9411

Vandermeer, John H., 9172
Van Meter, Harry D., 9547
Van Valin, Charles C., 9239
Vasil'eva, N. E., 9515
Vincent, Bernard, 9483
Vincent, Ernest Richard, 9048
Viox, Charles A., Jr., 9136
Visvesvara, G., 9434
Vladykov, Vadim D., 9298
Vogele, Louis E., 9382
Von Windeguth, Donald L., 9498

Wade, W. Frank, 9452
Wagner, Mary H., 9490
Walburg, Charles H., 9550
Waldbauer, Eugene C., 9485
Waldichuk, Michael, 9517
Wales, J. H., 9205
Walker, Charles R., 9034, 9035, 9037
Waters, Thomas F., 9246
Watson, Donald E., 9170
Webb, Deirdre, 9104
Weber, Douglas, 9195
Weisel, George F., 9182
Weiss, Charles M., 9393, 9529
Welker, Bill, 9399
Wellborn, Thomas L., Jr., 9046
Wendt, Curt, 9408, 9453
Whelan, Donald E., 9338
Wicklund, Robert, 9421, 9484, 9492
Wickwire, Russell H., 9366
Wilcke, H. L., 9202
Wilimovsky, Norman J., 9472
Williams, A. K., 9404
Williams, John E., 9374
Wilmot, R. L., 9325
Wilson, G. G., 9523
Wilson, Peter C., 9149
Winn, Howard E., 9181
Winther, John K., 9140
Wogan, G. N., 9210
Wolf, H., 9201
Wolf, Ken, 9306, 9307
Woo, P. T. K., 9108
Wood, J. W., 9245
Woodall, A. N., 9495
Woodey, James C., 9108
Woods, Roy K., 9338
Woodwell, George M., 9127
Wright, James E., 9165
Wurster, Charles F., Jr., 9127
Wyatt, Herbert N., 9341

Yasutake, William T., 9203, 9444
Yawn, Henry M., 9364
Yeo, R. R., 9505, 9511
Yerger, Ralph W., 9183
Yount, James L., 9417

Zabolotskii, A. A., 9454
Zaks, M. G., 9465
Zenner, H., 9488
Zeller, Howard D., 9341
Zharov, V. L., 9522
Zil'bermints, L. A., 9429
Zimmer, Paul D., 9143
Zorach, Timothy, 9227
Zubina, N. F., 9539
Zueva, K. D., 9467

SUBJECT INDEX FOR VOLUME 12

Age and growth,
bass,
largemouth, 9508
smallmouth, 9114
bluegill, 9106
carp, 9111
catfish,
blue, 9334
channel, 9334
cobia, 9398
Dolly Varden, 9101
dolphin, 9316
flounder, winter, 9160
pike, northern, 9449
reservoir in Kentucky, 9273
salmon, coho, 9057
salmonid embryos, 9153
scale reading recorder, 9457
spine study, 9141
squawfish, 9143
tautog, 9088
Tilapia, 9324, 9463
trout,
brook, 9137, 9230
brown, 9222, 9409
lake, 9390
rainbow, 9101, 9216, 9448
Anatomy,
carp, scale formation, 9111
eel sexing, 9242
form and feeding, 9104
gill dimensions, 9248
jaw forms, 9243
lampreys, teeth, 9298
mucopolysaccharides, new group, 9125
protrusible jaws, 9221
salmon,
coho, 9117
Pacific, 9164
sockeye, 9112, 9118
sound producing mechanism, 9181
suckers pharyngeal teeth, 9182
trout,
cutthroat (greenback), 9415
lake, 9294
livers, 9200
tunas, 9072

Behavior,
acoustic stimuli, 9429
attracted to laboratory, 9492
bullhead, yellow, 9546
cleaners of ectoparasites, 9459
dolphin, 9519
embryology, 9240
goby, naked, 9128
jaws and feeding, 9221, 9243
Behavior, cont.
lamprey, brook, 9481
light and oxygen, 9228
night observations, 9421
odor,
individual, 9232
schooling, 9231
reaction to electric current, 9466
salmon,
coho, 9031.
sockeye, 9121
shark vision, 9428
smelt, top, 9545
snapper, red, 9424
sound signals, 9458
trout, rainbow, 9477
tuna, little, 9086
Benthos,
aid in detection, 9144
Columbia River estuary, 9416
farm ponds, 9342
Lake Superior bays, 9229
Manitoba lakes, 9297
salmon food, 9454
Bibliography,
Canadian Atlantic fishes, 9026
oceanography, 9075
Oregon coastal waters, 9405
piscicides, MS-222, 9036
red-tide research, 9148
reservoirs,
ecology, 9266
United States, 9418
thermal discharges, 9414
waste and water treatment, 9215
Biocides,
algicides, 9432
herbicides, 9325, 9332, 9344
Aqualin, 9321
diquat, 9053, 9323, 9330, 9505
effect on Daphnia, 9235
paraquat, 9323, 9505
2,4-D, 9094
2,6-dichlorobenzonitrile, 9239
insecticides,
Abate, 9498
BHC, 9526
DDT, 9127, 9188, 9189, 9190, 9191, 9192, 9393, 9526
dieldrin, 9393
Dursban, 9506
endrin, 9317
fenthion, 9498
fish to detect, 9529
identification in fish, 9403
lindane, 9393
malathion, 9094, 9189, 9525
phosphamidon, 9189, 9193

Biocides, cont.
insecticides, cont.
Toxaphene, 9473
interaction of contaminants, 9524
molluscicides, cuprobam, 9431
parasiticides, oxygen, 9345
pesticides,
acceptable concentrations, 9276
detection, 9044
formalin, tadpole control, 9134
marine life, 9410
organochlorine, 9145
toxicities, 9528
piscicides,
antimycin, 9097, 9396
MS-222, 9032, 9033, 9034, 9035, 9036, 9037
organic pesticides, 9133
rotenone, 9100, 9341
toxaphene, 9042, 9473

Chemical factors,
ammonia, 9464
cobalt chloride, 9448
copper sulfate in redds, 9374
dissolved oxygen, 9228, 9278
effect of geyser on stream, 9048
fertilization, oxygen, 9353
following forest fire, 9247
hydrolysis of phosphates, 9045
oxygen,
and nitrogen supersaturation, 9095
deficiency on river lamprey, 9442
in stream substrates, 9377
potassium permanganate, 9336
removal phosphorus from effluents, 9081
toxicity,
drugs, 9344
industrial waste, 9343
varying salinities and survival, 9521
Competition,
bass, white and largemouth, 9339
Culture,
Argentine pearl fish, 9179
bass,
largemouth, 9349, 9363
striped, 9319
carp, 9450, 9504
catfish, flathead, 9347, 9348
Dolly Varden, 9142
estuarine fishes, 9371
fertilization of eggs, 9486
grayling, 9443
pike, northern, 9060
reservoir fishes, 9382
salmon, 9445
Atlantic, 9408, 9439
chum, 9441
coho, 9031

Culture, cont.
salmon, cont.
pink, 9113, 9441
sockeye, 9299
spawning channel, 9194
selection of breeders, 9499
trout, rainbow, economics, 9412
use of lake water, 9095

Diet,
catfish, channel, 9039, 9041, 9055, 9331
cottonseed products, 9201
effect of food processing, 9350
larvae, quantitative study, 9537
Oregon pellet, coho salmon, 9549
salmon,
chinook, 9038
sockeye, 9112
Disease,
bacterial kidney, 9307
botulism, Cayuga Lake, 9455
cerebral mycetoma, 9287
columnaris, control by temperature, 9245
columnaris-type, Britain, 9548
Dermocystidium fungus, 9194
dinoflagellates, 9352
furunculosis, 9444
"gas-bubble", salmon, 9196
glomerular cystic tumor, 9487
hemorrhagic viral septicemia, 9306, 9509
hepatoma, 9199, 9200, 9201, 9203, 9204, 9205, 9206, 9207, 9208, 9209, 9210, 9211, 9212, 9213, 9214
identification, 9445
pancreatic necrosis, France, 9474
salmon, sockeye, Cryptobia salmositica, 9108
Streptococcus, 9262
Distribution,
Alaska salmon, 9476
Atchafalaya Basin, 9357
billfishes in Pacific, 9249
Canadian Atlantic, 9026, 9154
Central America, 9175, 9176
Chukchi Sea, Alaska, 9472
Colorado River, Utah, 9456
darter, Cumberland and Tennessee Rivers, 9227
eel, European, 9242
Gulf of Mexico, 9482
Kansas River, 9518
Mississippi silverside, Arkansas drainage, 9469
northwest Atlantic, pelagic fishes, 9256
Oklahoma stream, 9452
salmon, pink, Russian River, 9370

Distribution, cont.
suckers, 9187
tunas, 9072
yellowfin tuna, tropical Atlantic, 9522
Drugs,
Bromex-50, 9069
chloramphenicol, 9252
control of parasites, 9479
steroid hormones, brown trout, 9426
toxicity tests, 9344

Ecology,
barrier reef, 9461
Chukchi Sea, Alaska, 9472
Columbia River estuary, 9416
estuarine inflow, 9503
marine, 9438
Oklahoma stream, 9452
Oregon coastal waters, 9405
polluted stream, 9050
reservoirs, bibliography, 9266
salmon, sockeye, fry, 9121
Economics,
Canadian Atlantic, 9026
Florida phosphate pits, 9355
Nevada trout pond, 9376
pollution control, 9080, 9219
trout,
culture, government or private, 9412
lake management, 9533
rainbow, 9078
salmon, Quebec, 9260
snow fences, Colorado, 9218
Electricity,
effect on brown trout, 9116
injury to bass and bluegill, 9379
pulsating, direct current, 9373, 9466
small stream sampling, 9462
Embryology,
behavior, 9240
effect of temperature on salmonids, 9153
lamprey (Lampetra fluviatilis), 9442
nutritional change, bluegill, 9538
quantitative nutrition study, 9537
salmon, pink, 9478
trout, induced defects, 9488
Equipment,
bottom samplers, 9029
culture of marine organisms, 9220
data recording camera, 9368
determining oxygen in stream substrates, 9377
egg counter, 9401
gill-net platform, 9064
hatchery release tank, 9113
hydrofoils on otter boards, 9314
marine aquarium, 32,000-gallon, 9089

Equipment, cont.
measuring board, 9140
purse seine for salmonids, 9138
rearing troughs and tanks, 9349
recirculating sea-water system, 9372
sampler-float unit, 9065
SCUBA, 9328
small plankton study, 9288
small-scale effluent bioassays, 9523
spreader for antimycin, 9062
spreading herbicides, 9325
stocking boat, inaccessible waters, 9372
trap for downstream migrants, 9063

Farm ponds,
bass and hybrid sunfish, 9132
bluegill, population control, 9059
catfish, channel, 9326
dynamiting, 9362
fertilization, 9351
Illinois, 9315
lime for benthos, 9342
oxygen by potassium permanganate, 9336
parasiticides, 9345
population balance, 9337
warm-water management, 9365
Fertilization,
effect on bottom Ciliata, 9435
farm ponds, 9342
light and oxygen, 9353
phosphate, 9351
Food habits,
African fishes, 9244
bass, striped, 9027
dace, longnose, 9173
Dartmoor stream, 9420
drum, freshwater, 9098
gars, Mississippi Coast, 9392
grayling, 9514
lamprey, sea, 9102
marlin, New Zealand, 9177
salmon,
Atlantic, 9192, 9454
sockeye, 9083
shad, threadfin, 9387
Swedish reservoirs, 9436
tautog, 9484
terrestrial insects in lakes, 9407
trout,
brook, 9096
brown, 9409
Oregon lake, 9394
tuna, little, 9086

Genetics,
mass selection of breeders, 9499
pike hybrids, 9300
sunfish, 9132, 9183
trout, 9165, 9174

Habitat improvement,
artificial reefs, 9447, 9460
dam construction, 9275
old tires, 9126
shrimp introduction, 9267
stream flow regulation, 9338
Harvest,
barracuda, Pacific, 9186
bass-bluegill, 9224
bass, reservoir, 9356
catfish, channel, 9326
Des Moines River, 9507
Florida, freshwater, 9322
longlining, 9149
marine, California, 9184
Michigan river, 9389
reservoir,
Bull Shoals, 9168
Kentucky, 9305
Louisiana, 9359
tailwater, 9340
salmon,
California, 9185
coho, 9549
Quebec, 9261

Identification,
Atlantic snappers, 9151
Canadian Atlantic, 9026
darters, 9146, 9178, 9227
lampreys, teeth, 9398
Missouri, 9152
salmon, 9117
sharks, 9170, 9490
suckers, 9187
toadfishes, 9180
trout, 9197, 9253
tunas, 9072
walleye-sauger, 9061

Life history,
salmon,
chum, 9283, 9286
pink, 9282, 9285
sockeye, 9281, 9284
shad, American, 9550
shiner, emerald, 9388
Limnology,
British Columbia lakes, 9105
brooks and streams, 9470
Dartmoor stream, 9420
fiord lake, Canada, 9295, 9296
Great Lakes, 9236
Lake Erie, 9547
Oneida Lake, 9158
Ontario lakes, 9169
reservoirs, Kentucky, 9270, 9271, 9272, 9301, 9302, 9303, 9304
stream mayfly, 9246
terrestrial insects on lakes, 9407

Management,
Alberta streams, 9470
artificial reefs, 9447, 9460
barracuda, Pacific, 9186
bass, striped, 9254
bluegill, copper sulfate in redds, 9374
Canada lakes, ice fishing, 9483
conflicting water uses, 9308
dam construction, 9275
farm ponds, 9132, 9315, 9336, 9342, 9345, 9365
Florida phosphate pit, 9355
Hokkaido lakes, 9532
introducing shrimp as food, 9122
Michigan river, 9389
Oklahoma waters, 9049
posted areas, New York, 9485
rearing pond midge larvae, 9417
regulation of stream flow, 9338
reservoirs, 9225, 9258, 9265, 9270, 9272, 9341, 9364, 9382, 9402
salmon, Atlantic, 9156, 9260
shad, American, 9550
shrimp, introduction, 9267
spreading antimycin, 9062
stocking,
Great Lakes, 9067
U.S. history, 9520
streamflow, Colorado, 9218
streams, California logging, 9250
transfer of migratory run, 9413
trout,
brook, stream-fed ponds, 9131
lake, 9120
New Brunswick lake, 9085
rainbow, 9078
reservoir, 9533
stream, 9543
use of old tires for habitat, 9126
weed control, Tilapia, 9135
Marking,
alligator clips, 9139
cold and mild heat, 9380
dye, trout fry, 9163
fin removal, 9400
flounders, 9090
injected dyes, 9092
salmon, Pacific, 9195
salmonids, 9091, 9381
scales and otoliths, 9378
vinyl tube, 9358
Migration and movement,
bass, striped, 9254, 9255, 9312, 9397
catfish, channel, 9399
Des Moines River, 9507
effect of velocity on salmonids, 9071
entry into fish lift, 9493
fishway orifices, 9289
reef fishes, 9103
salmon,

Migration and movement, cont.
salmon, cont.
effect of light, 9513
Miramichi, 9110
Pacific, 9309
pink, 9536
sockeye, 9073, 9465, 9471
snapper, red, 9424
squawfish, 9143
transfer from original route, 9413
trout, brook and rainbow, 9084

Oceanography,
bibliography, 9075
Chukchi Sea, Alaska, 9472
ecology, 9438
estuarine,
epifauna, Maryland, 9310
legislation, 9226
phytoplankton, Virginia, 9311
method of surface sampling, 9314
Pacific in July, 9147
research, free divers, 9077
surface temperatures, 9223, 9411
U.S. east coast data, 9076

Parasites,
bass, largemouth, 9419
control methods, 9479
ectoparasites on carp, 9069
freshwater fish, 9491
Itasca Park helminths, 9530
leeches, British waters, 9241
marine on freshwater sunfishes, 9320
salmonid cestodes, 9198, 9544
southeastern U.S., 9046, 9047
Texas monogenetic trematodes, 9531
trout, rainbow, 9480

Physical factors,
effect of,
dam on temperature, 9073
geyser on stream, 9048
temperature,
on bass growth, 9114
on embryo salmonid growth, 9153
Florida red-tide, 9150
heated effluents, 9437
light intensity, 9228
stream flow regulation, 9338
temperature, 9115, 9279, 9360, 9521
thermal discharges, 9414

Physiology,
blood lactic acid, 9259
catfish, channel, 9516
chromosome cytology, 9054
gill functions, 9248
goldfish, 9129, 9130
hydrocarbons in digestive system, 9079

Physiology, cont.
leukocytes, digestion and ovulation, 9540
metabolism, 9494
osmotic and ionic regulation, 9263
parr-smolt transformation, 9293
protein of salmonids, 9406
pyloric caeca and gill development, 9294
salmon,
Atlantic, 9453, 9515
chinook, 9040, 9495
chum, 9430
sockeye, 9112, 9465
scale loss and metabolism, 9292
serum,
complement, 9386
protein, 9087, 9107
sound-producing mechanism, 9181
taste, 9234
temperature, 9166, 9264
trout,
blood samples, 9058
lake, 9468
rainbow, 9425, 9427, 9477, 9539, 9541

Plankton,
automatic sampler, 9052
British Columbia lakes, 9105
cause of disease, dinoflagellates, 9352
estuarine,
Maryland, 9310
Virginia, 9311
oxygen and survival, 9434
pumps, 9288, 9383
river, Maryland, 9313

Pollution,
acetylcholinesterase in brain, 9404
bacterial indicators, 9497
bibliography, control, 9215
bioassay, toxic waste levels, 9277
coal-washer, Kentucky, 9269
coastal oil problem, 9068
control criteria, 9278
cost of controls, 9080
detergent levels, rainbow trout, 9541
economics, control by industry, 9219
effluent, bioassay, 9523
Great Lakes, 9236
hard ABS detergent, 9043
industrial, Florida coast, 9496
Ohio stream acids, 9155
oil refinery effluents, 9333
Oregon coastal waters, 9405
paper fiber sludge, 9391
petrochemicals, toxicity, 9527
phosphates, indicating organic wastes, 9081
radiobiology, Clinch River, 9274

Pollution, cont.
reclaiming wastewaters, California, 9510
red-tide, 9074, 9150
regional planning, 9233
resistance to oil pollution, 9361
safety factors needed, 9280
sediment from agriculture, 9543
sewage, 9346, 9367
stream energetics, 9050
sulfite wastes, coastal, 9517
temperature, power plants, 9279
thermal discharges, 9414
toxic levels, industrial wastes, 9343
Populations,
balance in farm ponds, 9337
Colorado trout lake, 9373
Delury Method of estimate, 9326
effect of sewage, 9346
reservoir,
bass, 9339
Kentucky, 9270
shad, threadfin, 9093
Predation,
African fishes, 9244
bluegill control in ponds, 9059
New Brunswick lake, 9085
trout on crayfish, 9096
Production,
bass, striped, 9329
catfish, channel, 9055
farm pond species, 9132
Florida phosphate pits, 9355
Lake Erie, 9547
primary, measurement, 9051
reservoirs, 9265, 9271, 9301, 9302, 9303, 9304, 9305
Ricker method computerized, 9119
salmon, sockeye, 9535

Radiobiology,
Clinch River, Tennessee, 9274
Cs^{137}, 9501
marking flounders, 9090
NaI^{131}, 9500
Sr^{90}, 9501
Reproduction,
bass, striped, 9319, 9354
catfish, flathead, 9347, 9348
cobia, 9398
dolphin, 9316
lamprey, brook, 9481
pumpkinseed and bluegill, 9124
reservoirs, Russia, 9534
salmon,
Atlantic, 9423
sockeye, 9118
spermatozoids and ovarian fluid, 9486
sturgeon, lake, 9167

Reproduction, cont.
Tilapia, 9475
trout,
brown, 9426, 9440
lake, 9366
rainbow, 9290
Research,
cooperative unit program, 9327
effect of pesticides on marine life, 9410
flounder, summer, 9162
free divers on Continental Shelf, 9077
oceanography, temperature, 9223
photography underwater, 9433
red-tide, 9148
resistance to oil refinery effluents, 9361
South Atlantic and Caribbean, 9542
University of Washington, 9385
Reservoirs,
basses, 9339, 9356
bibliography, 9266, 9418
bottom organisms, 9217
Columbia River salmon, 9513
dam construction, 9275
economics, Nevada trout pond, 9376
food habits, 9436
future, U.S., 9258
grayling,
food habits, 9514
reproduction, 9443
growth of fishes, 9273
management,
destratification, 9402
drawdown, 9364
Kentucky, 9270, 9271, 9272
Louisiana, 9359
Michigan, 9265
piscicides, 9341
stocking, 9382
stream flow regulation, 9338
plankton sampling, 9052
production,
Bull Shoals, 9168
Kentucky, 9301, 9302, 9303, 9304, 9305
reproduction, Russia, 9534
salmonid reproduction, Sweden, 9446
salt water, 9371
shad, threadfin, 9093
shiner, emerald, 9388
shrimp, introduction, 9267
southwest, uneconomical, 9257
tailwater fishery, 9340
transfer of migratory run, 9413
trout,
brown, 9409
management, 9533

Sampling,
eggs and larvae, Maryland river, 9313
electrically, 9373, 9462
hydrofoils on otter boards, 9314
larval fish, Wisconsin lakes, 9291
plankton in reservoirs, 9052
purse seine for salmonids, 9138
rotenone, 9230
salmon, chum, 9030
shad, threadfin, 9093
Specific,
albacore, 9147
alewife, 9159
barracuda, Pacific, 9186
bass,
Kentucky, 9273
largemouth, 9097, 9123, 9273, 9318, 9339, 9349, 9356, 9363, 9379, 9419, 9508
redeye, 9269
smallmouth, 9114
spotted, 9356
striped, 9027, 9028, 9254, 9255, 9312, 9319, 9329, 9354, 9397
bluegill, 9053, 9106, 9124, 9332, 9343, 9374, 9379, 9538
bullhead,
black, 9317
yellow, 9546
butterfish, Heniochus nigrirostris, 9459
carp, 9069, 9111, 9450, 9504
catfish,
blue, 9334
channel, 9037, 9039, 9041, 9055, 9259, 9326, 9331, 9334, 9335, 9399, 9516
flathead, 9347, 9348
tropical-freshwater, 9487
cisco, Bonneville, 9369
cobia, 9398
crappie, white, 9273
dace, longnose, 9173
Dolly Varden, 9101, 9142
dolphin, 9316, 9519
drum, freshwater, 9098
eel, European, 9242
flounder,
summer, 9162
winter, 9160, 9161
goby, naked, 9128
goldfish, 9129, 9130, 9524
grayling, 9443, 9514
lamprey,
brook, 9481
Lampetra fluviatilis, 9442
sea, 9102
minnow, fathead, 9094, 9172, 9502
pike, northern, 9060, 9145, 9449
Specific, cont.
pumpkinseed, 9124
salmon,
Atlantic, 9109, 9110, 9156, 9190, 9191, 9192, 9260, 9261, 9293, 9408, 9423, 9439, 9453, 9454, 9515
chinook, 9038, 9040, 9071, 9117, 9238, 9289, 9367, 9495
chum, 9030, 9283, 9286, 9422, 9430, 9441
coho, 9031, 9057, 9066, 9117, 9237, 9289, 9549
pink, 9113, 9282, 9285, 9370, 9422, 9441, 9467, 9478, 9536
sockeye, 9071, 9073, 9083, 9108, 9112, 9118, 9121, 9198, 9245, 9281, 9284, 9299, 9384, 9465, 9471, 9489, 9532, 9535
sauger, 9061
shad,
American, 9550
threadfin, 9093, 9360, 9387
shark,
basking, 9079
bull, 9170
shiner,
emerald, 9388
golden, 9262
silverside, Mississippi, 9469
smelt, top, 9545
snapper, red, 9424
spot, 9525
squawfish, 9143
sturgeon, lake, 9167
sunfish,
green, 9132
redear, 9132
tautog, 9088, 9484
Tilapia, 9070, 9135, 9318, 9324, 9463, 9475
trout,
brook, 9084, 9085, 9096, 9109, 9131, 9137, 9230, 9253, 9395
brown, 9116, 9163, 9222, 9400, 9409, 9426, 9440, 9451, 9464
cutthroat, 9136, 9171, 9287, 9415
lake, 9120, 9287, 9294, 9366, 9390, 9468
rainbow, 9056, 9071, 9078, 9082, 9084, 9085, 9099, 9101, 9107, 9166, 9197, 9203, 9204, 9216, 9270, 9289, 9290, 9292, 9306, 9425, 9427, 9444, 9448, 9474, 9477, 9480, 9488, 9500, 9509, 9539, 9541
tuna,
little, 9086
yellowfin, 9522
walleye, 9061, 9157, 9391

Stocking,
bass-bluegill, 9224
boat for inaccessible waters, 9325
ciscoe in Tahoe, 9369
Great Lakes, 9067
history in U.S., 9520
plastic bags, 9335
private versus government, 9412
reservoirs by local facilities, 9382
salmon,
Atlantic, 9156
chinook, 9238
coho, 9237
sockeye, 9532
trout,
brook and rainbow in lake, 9084
lake, 9120
Survival,
catfish,
channel, 9055
flathead, 9348
dynamiting, 9362
hard ABS detergent, 9043
Survival, cont.
petrochemical pollution, 9527
reef fishes, 9103
related to plankton and oxygen, 9434
salmon,
Atlantic, 9408
chinook, 9367
chum, 9422
pink, 9422
snapper, red, 9423
trout,
brook, 9395
brown, 9222, 9400
Oregon lake, 9394
rainbow, 9056, 9082, 9292
walleye, paper fiber sludge, 9391
Vegetation,
biological control, 9318
carp, 9450
reservoir, Delaware, 9268
silver dollar fish, 9511
Tilapia, 9475

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